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VOL. XXXVI

JANUARY - DECEMBER, 1902

NEW YORK
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1902

POPULAR SCIENCE NEWS
NEW YORK

O.K. Complete.
Index O.K

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POPULAR SCIENCE NEWS

ZINC AND LEAD MINE, JOPLIN, MO. (See Page 3).

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Weather Kites from Ships.

Prof. Hildebrandson, of Upsala, says that a meteorologist on a steamship provided with kites, and also with small balloons to ascertain the drift of the upper winds when there are no clouds, by making atmospheric soundings between the area of high barometric pressure in the North Atlantic and the constant southeast trades south of the equator, and in this way investigating the temperature and flow of the so-called anti-trades, could solve in three months one of the most important problems in meteorology.

A Law Against Long Skirts.

A law, it is announced, was introduced by one of the members of the Bayonne, N. J., Board of Health, making it a misdemeanor for a woman to wear gowns that sweep the street, as it is believed there is no more potent agent in the spread of disease than these collectors and carriers of baleful germs. In Pottsville the Board of Health has issued an order against long skirts on the streets, and the collection of cigar stumps is also prohibited.

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New Mosquito Items.

The same method is suggested as prevails among the French vine-growers in the region of Beaujolais for destroying the delta moth Pyralis, which works havoc in the vineyards. The owners of the vineyards have stationed acetylene lamps placed over bowls of petroleum around their areas. At dusk the lamps are lit and the thousands of insects attracted perish in the exposed flame or in the petroleum. In two lamps 50 yards apart in the course of 18 nights 170,000 of these moths were killed.

Mr. Brennan, of the Public Works Department, Jamaica, in a communication to the Liverpool School of Tropical Medicine, draws attention to his observation that mosquitoes will respond to a continuous whoop or hum, and gather around the head of anyone emitting such sounds in swarms. Whether there is some particular note or pitch that is most attractive to them is not known.

Incubators as Old as Pharoah.

Although artificial incubation, as a general pursuit, is quite modern. the idea of it dates back into very remote ages. The dusky subjects of the Pharaohs practised it, not indeed as we do, but in great sand-ovens known as "mohmals." The Chinese of the period of Confucius also hatched eggs—as they still do in certain parts of the Celestial Empire—entirely by the heat of the sun.

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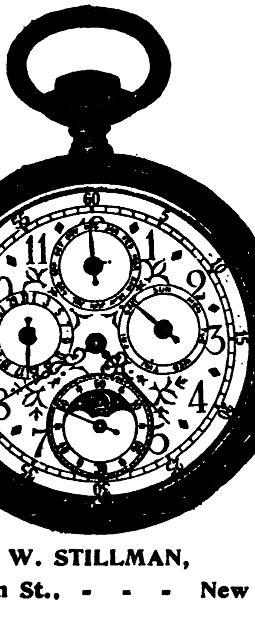

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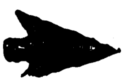

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ZINC AND LEAD MINE, JOPLIN, MO.

THE MINERALS OF JOPLIN, MO.

BY ROY HOPPING.

The city of Joplin, in southwestern Missouri, can hardly be called a typical mining town of the western United States. Not only is it a city of considerable size, with little to show that it depends on the mines for its livelihood, but it is also clean, modern and progressive. There are no mines within the city limits proper, although several streets emit a thunder-like rumble as the wagons and carriages pass over the shafts of former mines. It is said that the ground beneath the main business portion of the city is honeycombed with these old mines.

To reach the various mining camps of the Joplin district, one must take the trolley cars or the hacks that run periodically from Fourth and Main streets, the center of the city, to the different mines.

The mines consist of a straight, square shaft, cribbed with logs or planks, from which the ore is hoisted. In the "small propositions" the hoisting is done by hand or mule power, and the washing is done by putting the ore in a jolting box or tub suspended from the end of a long beam into a tank of water.

The mills, however, have a shaft house above the shaft, and the ore bucket is hauled up by a donkey engine. The ore bucket is the means of communication between the mine and the upper world. By means of it a shift of thirty or more men is hauled up in about five minutes, three men standing on the bucket during a trip. The speed with which they are hoisted or dropped is hard on the nerves of a visitor, but the matter-of-course way the miners step from the bucket as it reaches the top of the shaft is reassuring.

The chief ores of the Joplin district are the zinc ore, sphalerite, and the lead ore, galena or galenite. One is sulphide of zinc, ZnS., and the other is sulphide of lead, PbS. The miner's names are "jack" and "lead," and the local papers give the daily price for zinc ore and lead ore, together with that of spelter and pig lead, just under the daily weather prediction. Why the weather prediction is given preference is unexplained, for, as the miners say, "drouth can't spoil the jack crop."

The ore occurs in dolomitic limestone, cherty limestone and chert. The soft limestone mines are said to be in soft ground, while those in cherty rock are said to be in hard ground. The former are the best mines but the latter produce the prettiest specimens for the cabinets of mineralogists. The minerals of the Joplin mines are various and beautiful, especially if associated on one specimen, such combinations being very common. Sphalerite or zinc blende, the chief ore of the region, occurs in beautiful large black crystals, often irridescent. The crystal form is a rough dodecahedron, sometimes in trillings. It also occurs as translucent, brilliant brown blende, and in small red ruby blende specimens. Peacock jack is a beautifully brilliant iridescent variety, very rare.

Galenite, the lead ore of the region, occurs in cubic cleavable masses, fine large cubes, cubo-octahedrons and rarely simple octahedrons. Sometimes large cubes have smaller cubic crystals overhanging from the corners, forming interesting "bastion" crystals.

Calcite, in beautiful yellow scalenohedrons or dog-tooth spar form, is the commonest mineral associated with the ores. It occurs lining cavities and sometimes filling immense eaves, and the crystals often reach very large dimensions. Calcite crystals are called *tiff* or *tift* by the miners, and on account of their beauty they are valued more by them than the other minerals.

Pink, cream and white pearl spar dolomite, called simply "spar" by the miners, is one of the most common minerals found about Joplin. The rhombohedral crystals are generally curved, sometimes enough to produce "saddle crystals." They are usually thickly set, covering whole surfaces of limestone or chert.

The sulphurets of iron and copper are called "mundic" by the miners, who sometimes are able to make the distinction between "copper mundic" and "iron mundic." The commonest of these pyrites (iron mundic) is marcasite, the white iron pyrites. It occurs coating the galenite and dolomite. penetrating the sphalerite and included in the calcite crystals. This mineral is rather rare from other localities. The crystals are small spear heads or the interesting serrated coxcomb pyrites. Common iron pyrites, pyrite, is rather uncommon from this locality.

ZINC AND LEAD MINING WORKS, JOPLIN, MO.

Chalcopyrite or "copper mundic" occurs in small sharp tetrahedrons usually on pearl spar dolomite. When associated with sphalerite they are often penetrating the sphalerite crystals somewhat. Rarely these chalcopyrite crystals are set on the sphalerite crystals in parallel position, and each small triangular face reflects the light at the same angle, producing a beautiful golden "shiller."

The chert, which forms the base or core of most cabinet specimens from Joplin, is dark drab to light gray and often contains fossil shells, crinoids, etc. From some mines it is obtained in brecciated specimens, which make pretty mottled cabinet pieces, resembling agate when polished. Chert is called "flint" in Joplin.

It may be interesting to mention the details in brief of the mining methods of Joplin. The shafts vary from 150 to 250 feet in depth, and the ore is hauled up in a large bucket. This is placed on a small car and run along a trestle tramway to the platform where it is dumped. It is then folked into the crusher; from thence it goes to the washer, and is then sorted by gravity. The jack or zinc ore is then carted in wheelbarrows to the jack bin, the galena or lead to the lead bin, and the tailings are dumped on the waste pile. Some of these waste piles are immense. This waste consists of limestone and chert, and as it is already crushed to a small size, it makes excellent road material.

Every Saturday the ore buyers visit the mines and buy the week's product at the market rate, the price varying with the grade of the ore.

In the neighboring Cherokee County, Kansas, there are situated similar profitable mines.

The Decoration of Zinc.

A variety of beautiful colors may be imparted to zinc surfaces by a simple chemical application, continued a length of time proper for the desired color. It is essential that the metal be pure, and especially free from lead, and to insure this it is rubbed with silicious sand moistened with hydrochloric acid, then dipped in water, and rubbed vigorously with blotting paper. The zinc is now immersed in 3 parts, by weight, of dry tartrate of copper, in 4 parts caustic soda, with 48 parts distilled water, the whole at a temperature of about 50° F. The colors appear successively in the prismatic order, according to the period of immersion. Thus, in two minutes appears the violet, a dark blue in three minutes, a golden yellow in four and one-half, and a red purple in eight and one-half—intermediate terms giving intermediate tints. When colored, the zinc is well washed with water. It may be varnished.—Nat. Drug.pd.

Subterranean Temperature.

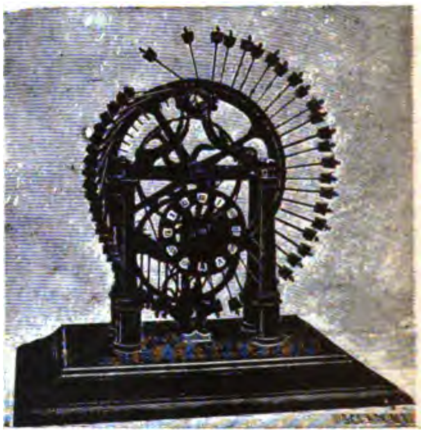
From late data, in a general way it may be said that each increase of depth of 28 metres (about 110 feet) corresponds to an increase of one degree in temperature.

Electrical Control of Water Faucets.

One of the newest patent applications of electricity is in making a more convenient faucet than that ordinarily used. Two pairs of electromagnets are suspended from the walls, each pair being mounted in such a way as to drive a piston up or down, according to which button is pressed. In this manner the piston opens or closes either the hot or cold valves and allows the water to flow into the bowl.

A Perpetual Motion Clock.

At the Paris Exposition there was exhibited a clock which ran for two months without having to be wound up, therefore the makers were somewhat justified in calling it a "perpetual motion clock." The inventor obtained his result by combining a system of jointed levers or armatures with permanent magnets in order to permit the wheel fo revolve indefinitely around its axis to coil a spring. The principle is based upon the fact that poles of the same name repel, while those of opposite names attract. Two series of movable levers are placed upon the faces of the rim of a large wheel. The two arms of such levers form between them an angle of forty-five degrees; the shorter one is provided at its extremity with a weight which acts as a counterpoise. The counterpoise most distant from the center has a preponderating action upon the side of the wheel. It makes four revolutions a minute, and actuates a regulating flywheel through the medium of an endless chain. The frame of the apparatus is constructed of magnetized steel. It supports the axle of the wheel and is surmounted by a roller that constitutes a pole. When in its motion the wheel brings the short arm of one of the levers opposite the roller, the phenomenon of repulsion is produced.—Sci. Amer.



PERPETUAL CLOCK.

An Oil Blow-Pipe.

Mr. A. Richardson has devised an oil blow-pipe, which, in the form of a meta tube 1⅛ in. long and ¼ in. in diameter, is fixed at an acute angle to the top of the flattened wick holder of a kerosene lamp. The wick, about 1 in. wide, is kept in place by a projecting tube of iron wire gauze. The lower end of the metal tube is closed by a perforated cap, through which passes the blowpipe jet, arranged to slide backward and forward. A thread of asbestos, dipping in the oil, projects just in front of the wick at the open end of the metal tube. When the lamp is lighted and left by itself, the asbestos gives a small flame at the mouth of the tube, but when the blowpipe bellows is worked, combustion takes place within the tube, and varies from a fine-pointed flame to a large roaring flame, as adjusted.

Animal Life

TARANTULA HUNTING.

BY ERNEST HORSFALL RYDALL.

Many hundreds of the enterprising people that have turned their faces from the old world and the densely populated districts of the East to the land of the setting sun—the rugged mountains and vine-clad valleys of California, are sustained by catering to that endless procession of visitors that annually seek rest, recuperation, or change of air, by a short residence or travel in the balmy climate of the Pacific. Large curio stores exist in Los Angeles and San Diego and San Francisco, for the purpose of gratifying the taste of the tourist; and in these not only are samples of native products sold, but the merchants engaged in the curio business are found regularly going to Japan, Old Mexico and Alaska to purchase large stocks of gods, skins, blankets, relics and curiosities, to attract the eye of the army of wealthy tourists who annually gather at the magnificent hotels of California, to escape the ice and snow of their native states by a residence in a latitude surrounded by an atmosphere similar to that of England in June, and by horticultural beauty that, doubtless, far exceeds in loveliness the hanging gardens of the Orient.

To cater to these visitors, a number of imported citizens find a livelihood. One will purchase large quantities of yucca wood and make it up into pin cushions and ornamental trifles to attract the traveler's eye; another will manufacture fancy articles of orange wood for sale; another will cultivate the beautiful pampas plumes for export; others, again, embark in the abalone shell business—a limitless quantity of these beautiful shells being ever at hand in the Pacific Ocean. Very few wild creatures formerly existed in California, because the state was then merely the limit of the Great American Desert; even the very Indians, nearly fifty thousand of whom used to wander around the barren mesa and grass covered valleys, have disappeared before the march of advancing civilization. Following these aborigines goes the horned toad, the centipede, the trap-door spider, the tarantula and ground squirrel.

Before the advance of the plow and the tourist, each of these tribes of nomads is becoming fewer, and it is more laborious to obtain them. A gentleman I have just had an interview with, makes it his business to supply the naturalist and curio stores with these singular specimens of California product—these living wonders of the Golden State. Nineteen years ago, when he crossed the country in a conveyance, the tarantulas, in the valleys north of San Diego, sometimes abounded so that the ground was covered with them, so much so, that the passengers were unable to descend from the conveyance for fear of being bitten by these little pugnacious wretches. He gave me an account of his experience as a tarantula hunter and purveyor to the local naturalist who supplies the museums and colleges of the east with this strange insect.

The tarantula is still found on the uncultivated plains of California, but where the plow has been he is not. Living in a hole in the ground, he erects a web at the entrance the catch the festive insect hovering above; and, every now and then, comes up from his subterranean residence to devour the catch. Crickets, insects of various kinds, flies, bugs, etc., are fish for his net. There, all alone, for a tarantula is too belligerent to have a companion, he eats his lonely meal. The hunter, finding an orifice in the ground, pours some water down, having his wagon at hand loaded with a supply of water for the purpose; the creature immediately appears and is seized at the throat by a pair of pincers; the rest of his body is too soft to be treated in that manner. Properly held at a respectful distance, he is placed in a small cardboard box, and there he will exist without food, water or exercise, for three months, if required.

Should the hunter pour water down the hole and then absent himself, upon his return within five minutes he has discovered that the industrious spider has built another web over the entrance, and is below awaiting notice of the arrival of prey. The mother tarantula, before gestation, makes a little soft bag of spun silk, in which she lays her twenty-five eggs. With her young she ventures to the happy hunting grounds above soil, but upon the least alarm the progeny jump on her back, and thus loaded she bolts back to the family residence and remains until danger is over. The female lives alone; each individual juvenile spider, when maturing, seeks its own residence, for their quarrelsome dispositions prevent their living in harmony together.

After a few hundred live tarantulas have been collected together, each in its individual box, for it is a case of "when Greek meets Greek" if they are placed together, the collection is forwarded to the naturalist, who removes the intestines from each spider and stuffs the carcass of the creature with cotton wool; it is then mounted on cardboard and left to dry for a month; after that it is ready for the professor in the east or elsewhere, who desires to add tarantulas to his collection, or for the trade. The operation of taxidermy involved is annoying, because the fuzz even blown from the insect causes irritation of the skin, and even with the best of remedies at hand, the operator has to leave work occasionally for several days to recover from the effects of the poison.

While the effect of the bite of a tarantula is not fatal, it is certainly, according to the reports, painful and distressing; doubtless, a bite received from one taken when filled with wrath at his arrest, would result in extreme suffering; but the reputation for fatality that has gone forth respecting the bite of the insect is, doubtless, largely grounded on the imagination. They grow to the comparatively enormous size of four inches in length, and have the usual spider quota of eight legs, with which they get over ground very rapidly.

The California tarantula matures in three years. A full-grown dead tarantula reposing upon a cardboard properly mounted, is worth in the open market twenty-five cents, but a live, active, and pugnacious member of the tribe, freshly caught and enclosed in a box, has a value of two and a half cents. While we may shrink in terror from the bite of a tarantula, how much more terrified must the ancient people have been who knew of no remedy, and therefore, compelled the bitten individual to dance until the effect of the poison had ceased.

There is another interesting spider finding a congenial habitat in the barren California plains; this is the "trap-door" spider; this individual creates a dungeon in the ground covered by a trap door, fastened with a natural hasp and staple; the only way to get him is to pry up his residence with a chisel. His domicile, however, is as much an object of interest to the entomologist as himself.

California produces centipedes and scorpions, lizards and horned toads, though, as stated before, these, like the Indians, before the advance of civilization, pass away and become, on account of their scarcity, objects of value and interest,—so much so that a certain few devote their time to the business of hunting them and find in it ample remuneration for the effort and expense.

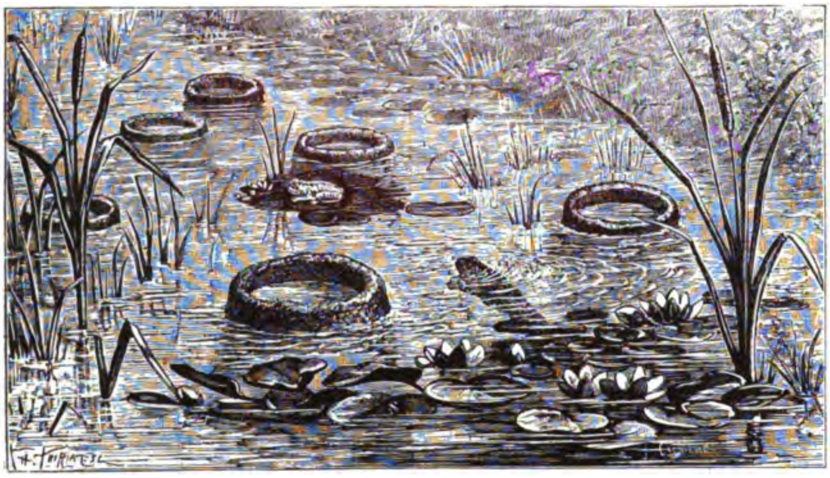
Large quantities of specimens of insects and small reptiles indigenous to California are annually shipped from San Francisco, Los Angeles and San Diego, to the east to supply the stores of large cities and museums, both public and private; one firm alone have this season sold 300 horned toads, and in the preparation of ornamental articles have used a carload of yucca stalks. Prepared rattlesnake skins, stuffed owls, quail, sea-birds, occasionally a tarantula hawk, are sold, and once in awhile, for they are getting scarcer every year, a condor is added to the shipments.

The only enemy of the tarantula, except man, is the tarantula hawk,—an insect of about the size and appearance of the common wasp; its wings are beautifully tinted in red and blue shades. No matter how large or fierce the tarantula, the little hawk will boldly attack him. After enjoying a few meals upon the spider's giant body, the hawks resolve it into an incubator in which to hatch their young. During the short rainy season of California these various creatures hibernate, only to spring up to renewed activity for the remaining ten months of the year.

A TREE-TOAD'S NEST.

BY HENRY WEBSTER.

The batrachians, including frogs, toads and salamanders, etc., often exhibit curious modes of laying their eggs and providing for the young. The common mode, familiar to us, is the depositing of the eggs in a string of nutritive jelly, in ponds. Tritons roll up an aquatic leaf like a trumpet, to contain the eggs and nutriment, and as protection against fish. A species of frog has the eggs affixed to its posterior legs, until hatched. A salamander of Ceylon and the North American Amphiuma dig a cavity in the soil near water, for a nest. Another salamander, the Desmognathus, fixes the eggs to the nape of its neck, like a bunch of toy balloons. Another batrachian secures its eggs between tree-leaves, whence the young finally drop into the water. The eggs of the Rhinoderma of Chili are matured in the throat of the male, who meanwhile abstains from food. The famous Pipa of Surinam forms cells for the eggs in its back.



NESTS OF HYLA FABER, OF BRAZIL.

The illustration shows the remarkable nests of Hyla faber of Brazil. They are pill-box in shape, made of mud, smoothly finished within, and are really the summits of hillocks built up by the toads from the bottom of a shallow pool. They have been likened to little volcanoes with craters, rising from the water, and remind one also of the round leaves of the Victoria regia with edges turned up. The use is of course to defend the eggs from predatory water-animals.—Condensed from La Nature for Popular Science News.

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Living Nucleus of Pearls.

M. Raphael Dubois reports to the French Academy that the minute larva of a distoma forms the nucleus of certain pearls, seeking to encyst itself. The mollusk may perish, releasing the distoma; if not, the pearl becomes large by the gradual deposition of lime salts, thus producing the most valuable pearls—the tombs of this kind of life.

TWO BIRDS OF A RIVER MEADOW.

BY HARRY EDWARD MILLER.

Through the crystal air of an early April morning, the pleasant whistle of a wandering meadow lark floated to me at intervals; and for all that the early day was so fresh and pure, yet it was the more so after the minstrel had poured his matutinals on the breeze. The stray lark was soon joined by a company of friends, whose sweet discourse grew into a concert, where they were perched on the tree tops in the center of a broad river meadow.

During the year of which I write, these birds had appeared in my neighborhood (southern New York) for the first on the twenty-fifth of March, which is a late day for their arrival, as, usually, it has been nearer the first of March, though, during one whole spring in the field, I did not see or hear a lark, nor could I find anyone who had. It is to be concluded from this last fact that the birds, for some peculiar and interesting reason, decided that another part of the country should be chosen.

In the fall the larks have been seen as late as November first, and I still expect to find them as winter residents, inasmuch as they are thus reported from where the cold season north of us is more severe.

The meadow lark is not properly classed with the long distance migrating birds, for it only journeys just below the snow line, and not always that far unless the cold and stormy weather cuts off the food supply. Probably, the records of his spending the cold months north of latitude 40°, at least in eastern North America, refer to open or comparatively open winters, instead of that season when denominated by the weatherwise countrymen as an "old timer; such a winter as we had when I was a boy." However, we should not expect all birds to be regular with their migration; and, besides, the movements of the meadow lark, and some others, are in harmony with the weather.

Notwithstanding that I walked almost beneath the tree where the birds which had called me from the river were singing, their musical exercises continued without interruption. Far above the loudest chorus, the prolonged "u-chee-chee," sounded constantly; while several individuals, for the sake of variation, would occasionally render it as: "ur-chee-chee;" or, with still another change, as: "urr-u-chee-chee." His brief song is hardly more than a half dozen whistled notes; which, because of its character, is easily recognized from a half to nearly a mile away. Uttered with a little quicker time than the other notes, it sounds nearest to: "fee-che-chee-ula-chee-chee-chee." Perhaps I am as much mistaken in calling this a song as though I had called his tremulous call notes enchanting melody. Certainly, many ornithologists assert that it cannot be so called with the best propriety; for, they hold, to claim such distinction, it must be fuller, longer, and possess more expression. And this they claim notwithstanding that they never hesitate in pronouncing as delightful songsters some birds less entitled to the name than our meadow lark. Again, there is another class of mankind that endeavors to measure bird melodies by songs of human composition, forgetting that the two are almost as unlike as the hemispheres.

To hear this early morning serenade, and to watch the guileless performers, would convince the most skeptical person that he must look only for optimists in the land of birds; and, though sad the truth may be, from nature to mankind he must go to find the pessimist.

In order to have a better view of my friends, I stepped carefully under their tree, with the effect of alarming the birds, which, with their cumberless flight, flew across the meadow, and, to give stronger foundation to their propensity for tree tops, were soon singing among the highest branches of a giant willow. And yet, I thought, as the bird notes came back on the wind, men will hunt these larks when the open season comes according to the game laws, and markets display their weak bodies for culinary delicacies. Verily, men of this character should be arraigned before the owl, that wise bird of birds, who would surely mete out to them condign punishment in the most deserved manner.

After that April day I met the meadow larks on every ramble I made. Sometimes they would be seen in the center of the town, whistling from the tops of the tallest trees, while the rumble and distraction of the moving panorama below did not in the least disturb the sensible creatures. Once, a member of his tribe forfeited his life by venturing too near the signs of civilization; and that tragedy happened when a lark was killed by dashing against the telegraph wires.

The general public is too little interested about the nesting life of our birds, for it is at this season that the observer will gather more information concerning his country's ornithology than at any other period he may spend in the field; and it is at this time, too, that the bird's character can be studied with the least trouble.

Let us for the moment pass over April and May and linger with June—pleasant June—when, after a diligent search, we can find the meadow lark's nest. We must explore wherever tufts of grass grow in the lowland fields and meadows, just where are located the homes of the bobolink and the red-winged blackbird. At last, we may be rewarded by finding the usual complement of four eggs of the marsh quail, or old field lark, as our meadow minstrel has otherwise been called. I know what it is to discover a bird's nest, after much patient searching. To a boy who has found what he had so long hunted for, the thoughts of Columbus as he sighted the supposed East Indies, are felt with complete understanding.

The eggs of this lark are slightly larger than the robin's, and are of a whitish or whitish-gray shade, more or less marked with specs and spots of light-chestnut scattered over the whole surface, but collecting thickest at the larger end of the shell. Second sets of eggs have been found in our meadows as late as the last day of July. The nest is constructed of coarse grass with a finer quality for the lining. This grassy structure is partly roofed, with an opening in the side to admit the builders—and a strange abode it is for birds to build, entirely unlike any other that I know, excepting the covered nest of the ovenbird or golden-crowned thrush.

The song of the mowing machine occasionally mingles with the madrigals of the father lark, while the near approach of the tramping team, dragging the ponderous monster, frightens the mother lark from her nest, when the cruel knives have many a time destroyed such cherished homes with their nestlings in the deep meadow grass.

But let us return to the April skies. As I have intimated, it was an early day of this month—in fact, the first—that I was passing in the meadows, where the foremost birds to migrate from the South were proclaiming the glories of nature. The day was already bordering on the twilight as I wended my way homeward, pausing now and then to scrutinize some bird as well as I could in the fading light, or to view another farther away by the aid of my opera glass; and once, when in the midst of these actions, I became conscious that a stranger, who was crossing the same field, stood gazing at me with no little astonishment.

"Well," he was probably saying, "that fellow is very much demented; certainly, his folks had better see to him before he does some damage, and gets sent to an asylum. He is a queer sort around peekin' in bushes."

Without doubt, he greatly pitied me, not knowing that he was the true object for pity. Yes, it cannot be denied that bird students of bird life are odd creatures in the eyes of a particular class of mankind; but on the otherhand, how exceedingly odd are those with no love in their hearts for nature!

From a clump of brier and dry grass, where it had gone to spend the night, a sparrow flew out with considerable haste, just as I had nearly trodden upon its roosting place. There was only a glimpse to be had of the creature, as it vanished through the dusk to alight in a thicket near the fence; but that instant flight revealed the bird's most prominent markings—the white on the tail feathers, by which I knew him to be the vesper sparrow, otherwise styled as the grass finch, and the bay-winged bunting.

A week later found me again in the river meadow to renew my acquaintance with the vesper sparrows, the number of which had been largely reinforced from the south during the last few days. Our vesper sparrow is an unsuspicious bird, and it causes him no alarm if the stroller approaches to within a few feet of his perch. He has another habit of running on the ground, like the quail, to elude inquisitive human beings. I have seen vesper sparrows run several yards before leaving the ground, and they would not then unless continually followed or too suddenly disturbed.

His song reminds me of both the field-sparrow's and the song sparrow's music, but still, its very resemblance differs from theirs. Opening with one or two soft notes, immediately followed by louder ones, the burden of his lay is: "a lir-lir-chur chur-chur;" finished after these notes with a lisping warble which could only be properly given with a phonograph. As for the song, what better praise can be ascribed to it than to call it a pure and sweet rural melody, frequently greeting the rambler when on his springtime perambulations?

There was a company of twenty-five vesper sparrows holding a strange musical reception. They were singing their vespers in concert, which formed a sweet and pleasant ditty, running: "chur-chur-churu-u-u-u u-u-u." One individual would start the tender strain and then all join with him until, sometimes, the whole twenty-five singers would be preserving such perfect time as would receive commendation from the instructor in music. Truly, nature does not mean to be excelled by the world, however loud may be the spontaneous praises for Mozart and Beethoven, for here these untaught minstrels, these simple-hearted creatures of so humble life, were executing in unison a madrigal which would be promptly lauded by all who had heard it for the first time.

One feature of our sparrow's music is that he sings both on the ground and in the trees, although nearly every other song-bird prefers an elevated position whence he may send forth his sweetest thoughts in melodious numbers.

Not all of the spring breezes waft the strains of the vesper sparrow across the fields and meadows, for he is busy with his mate, during the latter part of May, in selecting a building site, which, once decided upon, is immediately utilized for the nest. While June is their particular nesting time, we may also find their coarse nest built of grass near the meadow lark's in the May-time meadows. Then, too, in July, should we discover his abode, we understand that a second brood is being raised. Four or five eggs are all that the proud mother can properly hover; and she is rightfully proud of these prettily marked shells with a faint greenish-white ground, specked and spotted with lilac-gray, and light and dark chestnut; while, with some eggs, a few artistic pencilings of black or brown, or both, constitute the entire markings.

After the young birds have grown so large that they can depart from parental care and protection to mingle with the rest of their kind, these sparrows all form into foraging parties, as do many of our "ground birds"—an appellation probably received from the farmer's boy, and generally accepted by those unacquainted with ornithology. From the last of the first week until the middle of October, these sparrows are engaged in their migration southward; and do not return to us until the decline of March, or during the earlier fortnight of the month following, when nature, once more awakening from her winter-time sleep, shakes off her death-like repose.

White Plains, N. Y.

Extermination of the Antelope.

The ever extending limit of Western settlement and the extension of cattle ranches from the west concentrate the herds of antelope and gives the impression that they are increasing rather than decreasing. The "saddle of antelope" sells, delivered on the line, for $1 to $2, and to obtain this a steady business is carried on, resulting in the rapid decrease of the once numerous herds of antelope.

Just now the best antelope hunting district is west of Dodge City, on the Atchison, Topeka and Santa Fe Railroad, and east of Pueblo and Trinidad, Colorado. On the Kansas Pacific Railroad the finest herds of antelope are found west of Kit Carson and east of Denver. The animals are killed in great numbers by ambushed hunters, who take the saddle—i. e., the two hind quarters of the animal, together with any portion they may require for their own immediate use—and leave the rest of the carcass to be eaten by the coyotes. The saddle, as cut by them, weighs eighteen or twenty pounds, and is sold in the Kansas market at eight cents a pound, the hide in which it is wrapped being thrown into the bargain by the hunter. The Kansas Pacific Railway brings in great quantities of this meat, and the antelope, unless in some way protected, will be speedily exterminated.

Plant Life

THE HOLLY.

BY BESSIE L. PUTNAM.

That the use of the holly at Christmas festivities is of ancient origin is apparent from its mention in a carol written in 1450. The botanist Meehan gives a poetical version of associations that antedate the records of history: "If any reason could be found for the special veneration of the holly, it might be found in connection with the ancient Druidical belief that the woods were peopled by the spirits of the departed, and that it was the duty of the living to care for them. In very severe weather evergreens were hung in dwellings, so that these spirits might take refuge and have protection. In this respect, the prickly holly would naturally present special advantages." Be the origin of the custom what it may, the glossy evergreen leaves, so suggestive of hope or constancy, and the bright red berries, which symbol cheerfulness, are sufficient to render it ever a welcome Yuletide guest.

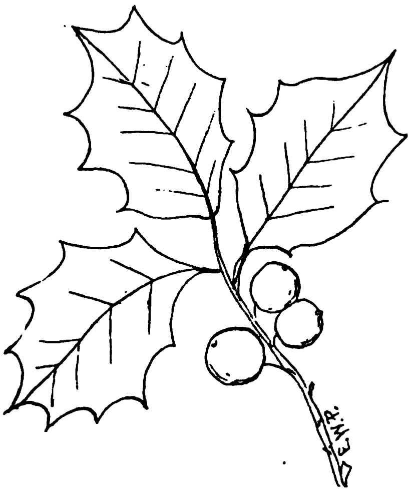
It is a tree of slow growth, native to both Europe and America, attaining here a maximum height of 50 feet and a trunk diameter of 3½ feet. The American species is characterized by less shiny leaves and berries slightly duller, though the variation is so slight as to be scarcely perceptible to the uninitiated, unless comparisons are made. In this country, especially among isolated specimens, trees without berries are frequent. This is readily explained by botanists: Individual specimens often lack either staminate or pistillate organs. If the former, they must rely upon the wind or some insect to bring the needed pollen from a neighboring staminate tree at the proper time, a precarious dependence unless neighbors are near; if the latter, no power can make it otherwise than barren, and its mission ends with furnishing pollen to its pistillate neighbor, and branches in which the berries of other plants may rest on the glad day. The fruit of the black alder, a near relative, is often worked in among the leaves of the fruitless holly with good effect.

From the fact that only the lower branches of certain species are spinous, Darwin worked up a very pretty little theory of evolution, which Grant Allen enlarged upon in this manner in his "Story of the Plants":

"Holly grows chiefly in wild spots, where all the green leaves are liable to be eaten by herbivorous animals. If, therefore, any plant showed the slightest tendency towards prickliness or thorniness, it would be more likely to survive than its unprotected neighbors. . . Holly, however, wastes no unnecessary material on defensive spikes, for though the lower leaves, within the reach of the cattle and donkeys, are very prickly indeed, you will find, if you look, that the upper ones, above six or eight feet from the ground, are smooth-edged and harmless."

The poet Southey gives the same thought:

"Below a circling fence, its leaves are seen
Wrinkled and keen;
No grazing cattle, through their prickly round,
Can reach to wound;
But as they grow where nothing is to fear,
Smooth and unarm'd the pointless leaves appear."



THE HOLLY.

And even though modern scientists may tell us that a sterile soil fosters spinous holly, and a fertile field develops that with a smooth margin, we still like to cling to the pretty theory of evolution on the ground that on the poor soil which could grow little other forage the holly would still need its thorny defense.

The wood is white, fine grained, and in much demand by cabinet makers, turners, and manufacturers of musical instruments. It is also used for wood engraving. As a hedge plant it is extremely popular. A yellow or white berried form is occasional. While its natural habitat is in moist situations along the Atlantic from Maine to Florida and Texas, it also creeps inland to Arkansas and Missouri, ascending to an altitude of 3,000 feet in North Carolina. This range may be materially increased by transplanting if the specimens removed are vigorously pruned in the autumn transplanting, and given a new home protected from the winter sun. This is extremely fortunate; for unless its culture is fostered in some way the slow growth must soon be exterminated by the immense quantities shipped annually to our metropolitan and suburban cities.

Vaccinating Plants.

M. Julien Ray, a French botanist, has announced to the Academy of Sciences the results of some very interesting experiments made by himself and M. Beauverie with cultures of the Botrytis cinerea, which causes ravages in conservatories and cold frames where seedlings and cuttings are forced, and which are easily obtainable by artificial culture on potatoes, carrots, etc. The results of this and other experiments have been gratifying, and it would not be rash to predict for his method a great future, considering the basis on which it rests.

A STUDY OF PLANT-SLEEP.

BY MAUD GOING.

Soon after sundown, or in early twilight, the foliage of many plants alters its position, till it has assumed an aspect differing markedly from that which is presented to the sun. To these movements of leaves, under the influence of approaching night, Linnæus gave the name of sleep.

A good example of it is shown by the leaves of common lawn clover. Soon after sundown, or even earlier if the plants are growing in shadow, the two side leaflets of each cluster of three turn forward till they have assumed the position of the covers of a closed book. Then the middle leaflet bends downward till it touches the edges of the pair, so that their nocturnal position suggests the fancy that the clover leaves are saying vespers, with heads bowed low above folded palms.

Some other members of the great bean family sleep almost as markedly as do the clovers. In the common locust, or false acacia, and in the wistaria, the end leaflet of each cluster hangs like a plummet, with its point towards the earth, and the side leaflets dangle in two rows, back to back. The leaves of the garden string beans assume a like position, while those of the honey locust are raised upright.

But the bean family plants are not the only ones which settle themselves for the night into positions seldom assumed during the day. The willow twists its foliage into a nearly vertical position. The leaves of the cornel and of the grape are slightly raised at their edges and depressed towards the middle.

All sleeping foliage is curiously rigid, and obstinately refuses to be twisted into any position save that which it has itself chosen to take. The rigidity of sleeping leaves is due to the presence of water in their tissues. And their position is invariably such as to bring the surface of the leaf into or towards a vertical position.

When morning breaks the plant awakens, and its leaves assume their work-a-day attitude. In our climate, mature and waking foliage spreads its green surface so as to intercept and catch the light as it falls from the sky.

All day, during the growing season, water ascends from the roots of the plant into its leaves, and there it evaporates slowly during the sunlit hours, giving up its mineral and chemical treasures. These are appropriated by the vital forces of the plant, to enter into the composition of cell walls and living protoplasm. Some of the gases which have come up as the constituents of the water are used in starch-making and tissue building. The gases and watery vapor which are left over from this process are breathed away mainly through the stomata,—minute orifices which exist in great numbers on the lower surface of leaves. More water comes up from the roots to supply the loss of that which has been withdrawn from the leaves by transpiration, and this, in turn, gives up some of its constituents to feed the plant.

But starch and protoplasm can be made only in the presence of light. So, as soon as light is withdrawn, whatever moisture is exhaled from stems and leaves passes out into the air without yielding up its treasures, and the plant thus parts with its fluids and gains nothing by the process. Hence, when sunlight has vanished nature checks plant transpiration. This checking is brought about in part by the action of the stomata, which remain open in daylight and close at nightfall. But the closing of the stomata does not completely check transpiration, which can go on, to some extent, through the skin of the leaf.

The so-called "sleep" of foliage seems an effort of nature to bring the leaf surface into a vertical position and thus to put a further check on transpiration. The leaf may be folded along the middle, or raised upright, it may turn over sidewise, or dangle with its point towards the earth. But in all these positions it is the edge of the green blade, not its surface, which is presented to the sky.

I have observed that in October and early November the foliage of many native plants inclines towards its sleeping position even in the sunniest hours of a sunny day. Perhaps these old leaves, whose forces are nearly spent, are unable to carry on the work of starch making and tissue building. So, there is no longer a reason why fluids should pass into their tissues and out again, and economical nature checks transpiration by turning the leaf-surface edgewise toward the sky.

Positions similar to those taken in their sleep are assumed by the leaves of many plants when excessive heat and light threaten to cause a too rapid transpiration of plant-fluids. And an erect position is habitual to the "phyllocladia," or flat green bodies which serve as foliage to some tropical plants.

The leaf, or its substitute, tries to turn its profile to the sky whenever transpiration has become excessive or undesirable, either by day or night. Hence we conclude that the sleep is directly connected with transpiration, and is only indirectly affected by changes in light, temperature or humidity.

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Rain and Earthquakes Priced.

Rain after drought in Australia "panned out" at $25 a minute in one district, while earthquakes have been assessed by a valuator in Japan at 100 guineas per quake. A gale cost $150,000 in the West Indies not long ago.

Neo-Vitalism and Plant Movement.

One of the discourses at the recent meeting of the British Association was by Mr. Francis Darwin, on the movements of plants, a matter first studied by the great naturalist, his father. A series of photographs showed how the movements of stem and root are normally controlled by the growing tip in all cases and how the directions of both portions of the plant are kept vertical in spite of disturbing causes. It was also shown that when the growing tip of the stem was "blinded," by covering it with a sheath of tin foil the guiding influence of light is abolished.

The tip of the stem, or root, acts as a sense organ, directing the growth at the zone of elongation, which is seated further back and corresponds to the motile organ of an animal. The Presidential address had expressed the view that the laws of nature could not be interfered with by living matter. The neo-vital school would, in the main, agree with this view. Their assertion is that to describe completely the phenomena of life the notions of chemistry and physics are necessary, but not sufficient. Mr. Darwin emphasized this view by demanding that the phenomena of plant movement should be regarded as psychological; and by describing them in terms of memory and even of consciousness.

The issue between the old and the new schools is more clearly drawn. The older school maintain that all the phenomena of life, however unintelligible they may seem, will ultimately be explicable by chemical and physical notions, while their opponents, who emphasize the fact that such notions do not now, certainly, completely explain the phenomena, refuse to bind themselves to prophecies.

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Bees Help Raise Peaches.

At the Oregon experiment station the experimenters forced a number of peach trees into bloom under a glass last November, and introduced a colony of bees into the house, first protecting one tree so that the bees could not get to it. From that tree all the fruit dropped when the stones began to form. From the other no fruit dropped, and it was abundant.

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City Plants Sleepless.

Hardly so, but it will not do to be too positive about anything where any kind of vibration is involved, though "sleepless" must be used metaphorically in reference to plants.

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San Jose Scale Enemy.

An important announcement was lately made by L. O. Howard, the U. S. entomologist, of the discovery of the long-sought original habitat of the San Jose scale insect; this was found to be in China, in the region to the south of the Great Wall. The scale insect was preyed upon by a species of ladybird beetle, living examples of which have been imported, to be propagated and distributed.

Archaeology

LEHIGH VALLEY INDIAN SITE.

BY HARRY J. IVEY.

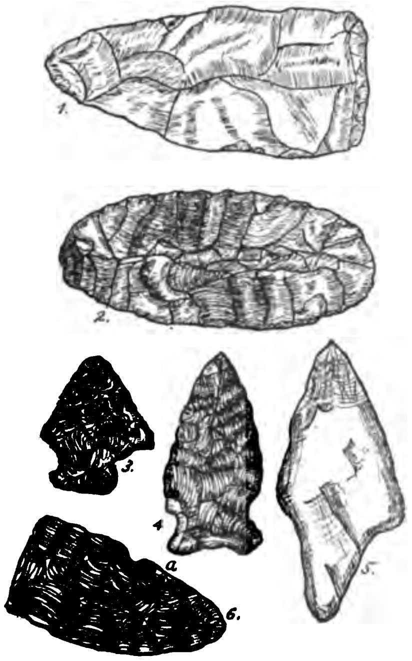
Much has been written about, and a great deal of time and energy has been spent in studying, the numerous and very interesting Indian village sites in the Delaware valley. The reverse is true of its main tributary in the north—the picturesque Lehigh. One spot in particular has attracted my attention, and to this I desire to call attention in this paper.

On the north side of the Lehigh river, about four miles east of Bethlehem and just north of the place where the Lehigh river was crossed when the famous "Walking Purchase" was made in September, 1737, giving to the white settlers a large tract of land, including the celebrated hunting grounds on the Minisink, there is a level stretch of land between the river and an anticlinal roll of the Trenton Limestone. Here was undoubtedly the site of a large Indian village.

The surface of this part of the river valley is covered with sand to the depth of eight or ten feet, evidently deposited by the river during the process of cutting its channel to its present depth, and it is in the upper strata of this bed of sand that most of the implements are found. The exact location and plan of the village cannot be determined because of the fact that large quantities of sand have been and are still being dug out and sent away, thus destroying the marks by which the plan of the village might have been determined, and also scattering many of the relics that have been found here. This notice will be confined to a description of a few of the specimens that I have been able to collect.

Fig. 1 is a scraper or celt scraper made of yellow jasper. The material for this scraper was transported from the jasper quarries at Durham, Bucks county, a distance of at least twelve miles from the place in which it was found. The chipping on this scraper is large, as shown in the illustration. The scraper edge is on one side of the median line, which is characteristic of all celt-like scrapers. The point of it is chipped in such a manner as to make it useful as a spear point if necessity demanded it.

Fig. 2 is an elliptical, leaf-shaped implement, quite symmetrical in outline and shape. It is also made of jasper but is brown instead of yellow. The chipping of this implement is quite regular and was evidently the work of an expert in the art. The flakes nearly all point toward the centre. Of the use of these leaf-shaped implements, Prof. Wilson, of the Smithsonian Institute, says in his Study of Prehistoric Anthropology, "Whether they were used as spear heads or knives, whether they were objects of ceremony, whether they were intended for practical use, is not known,—neither does any one know whether they were to be used in the hand or were attached to a handle."



HALF ACTUAL SIZE.

They have been found in every part of the United States.

Fig. 3 is an ordinary arrow point of the stemmed variety. It is quite symmetrical with the exception of one barb, which is somewhat longer, more pointed, and has sharper edges than the other. It is made of gray hornstone, boulders of which are found quite plentiful in this vicinity.

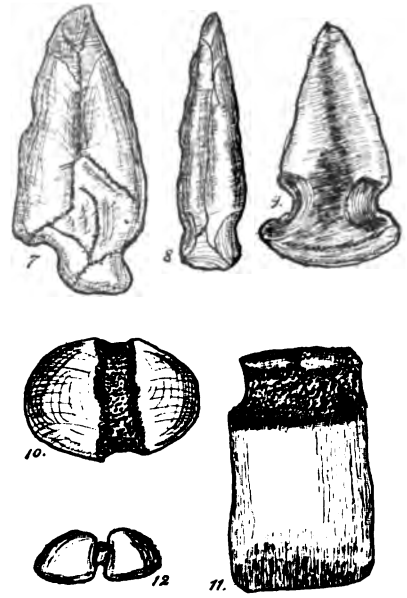
Fig. 4 is made of black flint, which is also local material. It is ot the wide stemmed variety, with a wide blade, convex edges, slight barbs and concave base. Fig. 5, also of black flint, belongs to the stemmed, barbless, chipped flints. It will be noticed that the edges have a double curve, convex toward the point, curving outward at the shoulders, and concave toward the base. The chipping on this specimen is very rough, the fractures being plainly visible and was apparently the work of a beginner or one not an adept.

Fig. 6 is a very interesting specimen. It is made of yellow jasper from the Durham quarries, and is crossed by tiny veins of chalcedony. This specimen belongs to the stemless variety. Base straight, corners square, one edge more convex than the other, both curving gradually and regularly to a point. This variety has been variously classed as knife, scraper, and spear head, but the one in question seems to have been made for a double purpose. The edges are sharp, making it useful as a knife, the point adapted to the use of a spear, while the base is of a form to make an excellent scraper; but it will be noticed that on the least convex edge is a semicircular indentation, which, as can be readily seen, is not the result of an accident, it being nicely chipped; it was presumably designed to be used as a "crescent stone."

Figs. 7 and 8 are arrow points of the stemmed variety, made of argillite. The material for these arrows was either transported from Bucks county, along the Pennsylvania Palisades, or the arrows themselves obtained by barter from the Indians in that part of the Delaware valley. As argillite is a material that erodes very easily and rapidly, the surface of these arrows is nearly smooth, except where the more prominent ridges were left by the original chipping.

Fig. 9 is an arrow or spear point with a wide stem and curved base. It is made of gray quartzite, which is found scattered around on the surface profusely in the vicinity of the village. The stem is worn quite smooth by being bound on the shaft, to which it must have been attached by means of thongs.

Fig. 10 is an interesting specimen and somewhat of a rarity in this immediate neighborhood. It is made of a quartzite pebble entirely encircled by a groove. Grooved stones of this size and variety were no doubt used for various purposes, and while they have been usually classed as hammer stones and netsinkers, it has also been observed that they were secured in the heads of war clubs, and also used as slungshots with a string about a yard and a half long attached, the other end being tied to the arm above the elbow.



HALF SIZE. (10 AND 11, ⅓; 12, ⅛ SIZE).

Fig. 11 is a grooved ax made of one of the river gravels. It is a good specimen of its kind,—the groove being deep and worn smooth by its being attached to a handle. The blade is nicely polished to a sharp edge, and the head had been fractured. Many other axes of different varieties have been found on the site of this village, but I have been fortunate enough to secure only this one.

Fig. 12 The last illustration given is a ceremonial or crescentic banner-stone, made of steatite, which material was obtained along the Delaware river north of Easton, Pa.,—a favorite place for all the tribes of Eastern Pennsylvania. to obtain material for implements that did not necessitate the use of a very hard stone. Each end is crescent or somewhat semilunar in shape, with a midrib between them for a perforation. The sides are dressed down quite thin and the surface of the whole has been polished.

It is to be hoped that the work of systematic investigation will be taken up in this valley, before civilization has forever effaced the places where these people once lived, and where their implements and weapons were scattered and lost.

Prin. Pub. Schools, Freemansburg, Pa.

GRAVES OF THE LACUSTRINE AGE.

BY EDWARD A. KILIAN.

Among the remains of the Palafitte or Lacustrine age, which are taken in large quantities in Switzerland from lake bottoms, or from lake-beds which have become peat bogs, very seldom human bones are found. This led to the supposition that these settlements had been gradually abandoned in time of peace. Had conflicts taken place, many human bodies would have fallen between the piles, or in the water in the vicinity of the settlement, and would have come to light again, as skeletons or parts thereof with other finds; hence the Palafitte or Lacustrine men must have buried their dead on land.

During the thirty years that these investigations of the ancient lake dwellings have been in progress, only one burial place belonging to the Lacrustrine age was found, namely, in 1876, near Auvenire on Lake Neuchatel, although everywhere the shores of the lake have been turned over in tilling the ground or building railroads. Very recently the theory of burial on land has been substantiated as correct by the discovery of a series of graves above Pully in Lausanne. According to the current reports about these excavations in newspapers published at Vaux and Geneva, these graves date from the earliest Stone-age, while those at Auvenire belong to the Bronze age.

They are cist-graves, formed by four stone slabs, over which a fifth forms the cover, in the same way as described in a former article on Sitting Burials. All graves are narrow and short, although each contains two skeletons. The corpses were at the time of burial compressed, the knees to the shoulders. In each grave are two skeletons, a male and a female, in another two children. The other contents are as meagre as poor; up to the time of the reports only perforated boar teeth and perforated pieces of bone, and some pieces of red and yellow ochre were found.

The excavations are conducted under the auspices of the Cantonal Educational Office. On this occasion people remembered similar graves at Chatelard, containing pottery and spindles.

Bogus Relic Dealer.

D. Levering, of Jonca, Mo., was arrested on November 8th, at the instance of Post Office Inspector C. N. Moore. He was charged with using the mails to defraud, viz : the making of stone and clay "archæological specimens," and the selling of same as ancient forms. He was arraigned in the U. S. Court at St. Louis, where he pleaded guilty to the charge of using the mails in the furtherance of a scheme to defraud. Judge Adams sentenced him to serve a term of 6 months in the Iron County (Mo.) jail.

As Levering sold his fraudulent specimens to many collectors, this will be welcome news.

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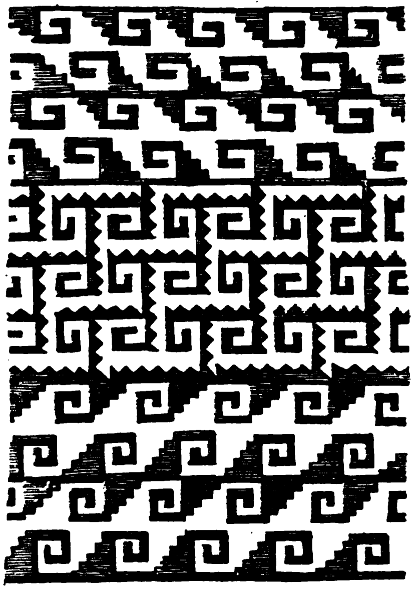
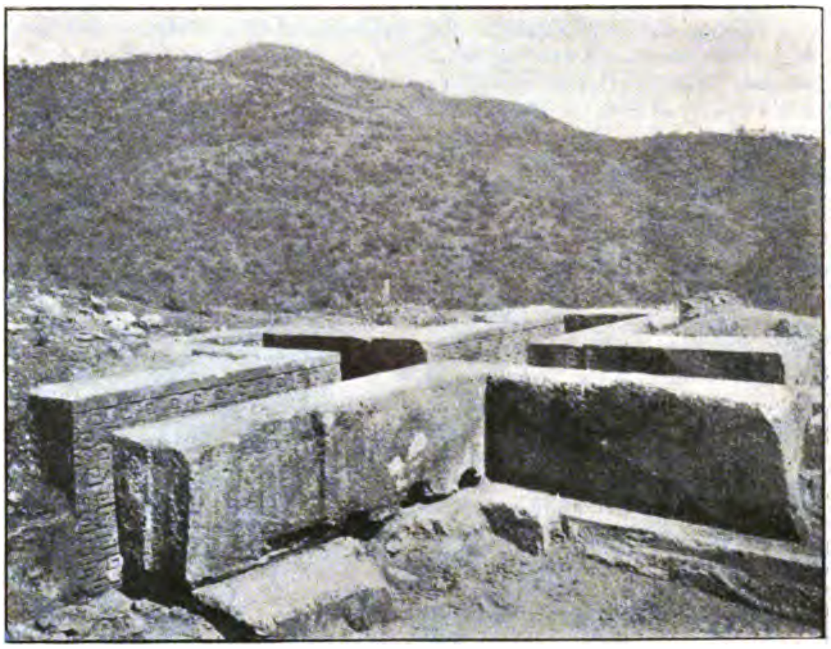
Ruins of Upper Guiaroo.

From a bulletin of the American Museum of Natural History, by Marshall H. Saville, we condense an account of these singular cruciform ruins, with illustrations. The great cruciform subterranean chamber, shown in Figure 1, is destined to be one of the great attractions of Mitla in the future. It is on the upper part of the hill about one hundred feet above and six hundred feet north of the main group, a little more than four miles east of the Hacienda of Mitla. To the northwest and higher up in the range of hills, about one mile distant, are the old quarries from whence were transported, in the ancient times, the immense blocks of stone which form the door lintels of the more important 'Palaces' of Mitla. Many immense quarried stones still lie scattered about at the quarries, while others have been partially broken out from the bed rock. The large blocks used in the construction of the cruciform chamber were transported from this place, and on the road between these two points are several large blocks which were evidently being moved to the chamber when the work ceased. The method of transportation was probably by means of rollers and large ropes. The stones were dressed at the quarries and the 'mosaic' designs carved after they were placed in the structure.



2. PATTERN OF DECORATION.

In an article on 'Oaxaca and its Surroundings,' by Dr. N. H. Wheeler, published in the POPULAR SCIENCE NEWS for January, 1896, this cruciform structure is mentioned; and in a small brochure issued later by the Mexican National Railroad, under the title 'Tropical Tours to Toltec Towns,' the writer quotes from a newspaper article signed 'W.' (probably Wheeler) in which a brief description with measurements is given of this tomb. The chamber was covered by forest and half filled with debris, composed of rubble stone and earth. Apparently this structure was never completed. The debris with which it was partially filled did not contain the slightest trace of remains of human workmanship, and had probably fallen down and washed in from a ruined structure occupying a pyramidal-shaped mound about twenty feet in height; the base of this mound adjoined the northwest corner of the structure. The perfect joining of the immense blocks reveals the absolute mastery of the stone worker's art. The carving was done after the walls of the chamber were completed, and the designs must have been traced out on the wall surface before the cutting of the 'mosaic' patterns. Stone chisels might have been used and probably this tool was the one employed by the ancient workmen.



I. RUINS OF UPPER GUIAROO.

There are three different designs in the decoration. A drawing of the end of the northern arm is shown in Figure 2; whether the grecques are purely decorative or are conventional symbolism it is impossible to say. These three designs form continuous bands of decoration around the chamber. The depth of the carving is about three fourths of an inch, and as a rule the serrated edges of the patterns are slightly beveled. In one place which was well protected from weathering by the debris, a small section of the design still preserves on the part in relief a very thin coating of cement painted red. The floor of the chamber is not cemented, another proof of its unfinished condition.

The dimensions of the chamber are: Extreme length from east to west, 32 ft., .8 in.; extreme length from north to south, 28 ft., .6 in.; length of northern, eastern, and southern arms, 11 ft., .7 in.; width of northern, eastern, and southern arms, 5 ft., 2 in.; length of western arm to end of sculpture, 11 ft.; total length of wall, 15 ft., .9 in.; width of eastern arm, 5 ft., .2 in.; height of chamber, 7½ ft.; dimensions of largest block, southern wall of western arm, 12½ ft. × 3 ft., .3 in. × 3 ft.

Two stone heads were also excavated near by, one of which is beautifully carved and is one of the finest pieces of stone carving from Oaxaca. It is perhaps a portrait of one of the former occupants of this locality; the aquiline nose is one of the characteristic features of the modern Zapotecan Indian.

The massiveness of the construction, and simple and chaste ornamentation, place these great Mitla tombs in a class unapproached by any other known burial chambers in ancient America. So far as I am aware, outside of Yucatan no other group of buildings with the exception of Mitla have this 'mosaic' style of stone work. In the whole area of Maya culture the style of roof is what is known as the Mayan or triangular arch, whereas in the Mitla buildings a flat roof was used. On the tops of some of the walls in the Mitla edifices may still be seen the mortar sockets in which formerly rested the ends of wooden ceiling beams. The absence of carved monoliths at Mitla is striking, when we consider the great monolithic lintels of one of the 'Palaces,' where there are single stones nearly twenty feet in length. It seems very probable that Mitla and the Yucatan ruins belong to the same epoch and are the remains of a people having kindred ancestors I have elsewhere offered the suggestion that the building of Mitla was by the Nahuas, and that Zapotecan occupancy was the result of conquest. Modern research points to a common ancestry of both the Nahuan and Mayan peoples.

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Prof. Mosso on Race Characters.

In his book on America, Prof. Angelo Mosso, the noted Italian physiologist, does not believe in the form of the skull as being the differential element of racial types and an index of the psychical tendencies of each. "This is," as he puts it, "a puerile form of materialism. Our present knowledge of the structure and function of the nervous system does not warrant our attributing such a prominent importance to the form of the skull. The alleged measurements of the anthropologists are entirely worthless as a means of determining the psychical tendencies of a man or a nation."

The difference in the form of the skull and in the color of the hair, upon which the entire structure of Ammon and Lapouge's anthropo-sociology is based, he regards as due to the combined action of altitude and temperature—i. e., to the climate. Inhabitants of the mountains have fair hair, while inhabitants of the plains have dark hair. Livi has conclusively shown that all over Italy—including Sicily and Sardinia, where the so called northern races never reached—the mountains are inhabited by fair-haired men. Since the color of the hair is dependent upon the deposition therein of a varying amount of pigment ultimately derived from the blood, it is not difficult to trace the connection between the climate and the phenomena of oxidation which are at the bottom of the production of pigmentary matter.

On the other hand, the dissimilarity in the form of the skull, upon which so much stress has been laid by anthropologists, is merely due to the lack of correlation between the size of the body, which is influenced by altitude and temperature, and the size of the brain, which is left unchanged. There are no races in the old metaphysical meaning of ethnic groups governed by congenitally blind impulses. The differences among men are all traceable to the action of climate and education. The Germans and the Scandinavians are, together with the Latins, the presentatives of the same Mediterranean e, which, according to the most accepted view (Sergi, Ripley) was the primitive bitant of Europe.—Science.

Minerals

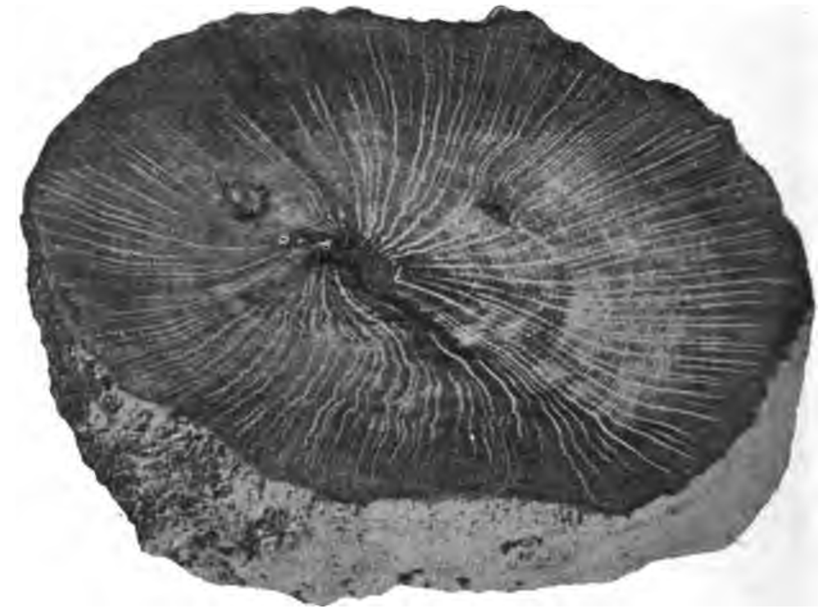
[Edited by A. C. BATES].

Pseudomorphs are always records of past existences There are several kinds of pseudomorphs—by alteration, formed by a gradual change of composition in a species; by substitution, those formed by the replacement of a mineral which has been removed or is gradually undergoing removal. The mineral appears under a form of crystallization which does not belong to the species. All minerals are finally determined by their chemical composition and not by their crystalline form. Thus we have a crystal of the form of calcite, which was made up of calcium carbonate, but is now quartz (silicon dioxide), by alteration.

Pseudomorphs by incrustation are formed by one mineral crystallized evenly over the crystals of another mineral so as to form a cast of that mineral, and from this the older mineral may be dissolved away.

One of the most interesting pseudomorphs we have is that of steatite, one of the softest minerals, replacing quartz, and found in fine specimens in Bavaria. The semi precious mineral known as "tiger eye" is a quartz pseudomorph after crocidolite, and is found in Gricua Land, South Africa.

Petrifactions are in reality a species of pseudomorphic formation. In some cases the original substance has been replaced by some mineral which has preserved not only the external form but the minutest detail of internal structure. Thus in some petrified woods we may determine the species because of the perfect preservation of the distinguishing details. The wood in the engraving is determined as white oak. The commonest petrifying substances are silica and carbonate of lime. Ordinary waters hold in solution more or less mineral matter, and such waters lying upon and filtering through the earth's crust are constantly active in dissolving and decomposing minerals and rocks, and species reputed indestructible are thus acted upon and thus furnish the waters with agents capable of making other chemical changes. The action is universal and goes on everywhere. In some places forest trees have fallen and become silicified. Sponges and corals are very common forms of silicification.



POLISHED BRANCH OF OPALIZED WOOD FROM CLOVER CREEK, LINCOLN CO., IDAHO.

Showing the replacement in minute detail, of wood cells, fibre. and structure, by a lustrous brown and yellow semi-opal. It is the most perfect and beautiful petrifaction yet discovered.

Some mineralized substances differ from the above, as wood or peat, altering into coal, anthracite and graphite. Reports from Christiana, Norway, describe with great particularity a natural phenomenon just brought to light there. Petrified tropical fruits have been found in coal from Spitzbergen, in the Arctic Ocean.

Tourmalines.—Some crystals remarkable for extraordinary size and variety of color have within the year been found in Mesa Grande Mountain, San Diego Co., Calif. The locality is at an altitude of 5,000 feet and was discovered in 1898 by parties prospecting for lepidolite, an ore of lithia. The tourmalines are found associated with lepidolite and quartz, and in isolated crystals of distinct form, some having double terminations which present unusual planes. Some are transparent and afford gems, and in some crystals there are as many as five colors, the pink rubellite predominating. Some authorities say the locality is likely to prove the best tourmaline deposit yet discovered.

The Bement Collection of Minerals was formally opened for inspection at the New York Museum of Natural History on Founder's Day, November 26, together with a fine collection of gems. Both of these collections are the gift of Mr. J. P. Morgan, and are said to be the best in the world. The gems and crystals are so beautiful that they will attract and hold the attention of the layman as well as the student.

Diopside is a calcium-magnesium variety of pyroxene and occurs in splendid crystals in veins of steatite at Richville, N. Y. Most of the crystals have sharp angles and good terminations, and some afford perfect gems of bright green color. The easy cleavage of the mineral makes the cutting of gems a problem to the lapidary. Another problem is the one of freeing the crystals of the steatite, a mineral not easily affected by the acids. But after much experimenting with various chemicals it is recommended that the crystals be put to soak in strong solution of salt water, and as the steatite softens to scrape it off with a knife and then scrub with an old tooth-brush. As a good many crystals were mined last fall which will find their way to collectors, the recipe given will be appreciated.

Collecting Minerals.—The Germans are great mineral collectors, it being no uncommon thing to find two or three collectors in a single family. Moreover, unlike American collectors, the Germans study the composition of their specimens, and this may in a measure account for their knowledge of chemistry and love of analysis. We should be the gainers by adopting the German method. Minerals are easily acquired, and may be kept in good order at little expense. Books teaching blowpipe and other methods of analysis, crystallography and geology may be had by beginners for home study, and at this writing there is a greater demand than there is supply for proficient mineralogists.

Mine Pockets.—The Lee Mine, of Leadville, Colorado, produced over $125,000 in one day's work from a pocket. Another famous pocket was that of the Moose Mine, Park County, Colorado, which gave up more than $1,500,000. Cavity, pocket or cave when opened on a mineral bearing seam, may be always relied upon to yield a wealth of treasure according to the mineral.

Cosmic Dust.—It has often been claimed that the presence of nickel in dust is a sufficient criterion to distinguish it as of cosmic rather than terrestrial origin. It has lately been shown that nickel is found in soot, and hence that nickeliferous dust may be terrestrial. Gallium, also, is found in all aluminous minerals, in many flue dusts, in many iron ores, in soot and in atmospheric dust.

John Hays, the first white man to discover the immense copper deposits of Michigan, still lives in Cleveland, O., and is ninety-seven years old. The peninsular of the Great Lakes is the richest mineral bearing territory in the world.

Photography

Photographic Notes.

Most photographic manuals advise dusting the plates with a soft brush before placing in the dark slides or holders, with a view to the prevention of pinholes. My experience, says Edwin Holmes, in the *Eng.* Mechanic, is that pinholes are either the result of this very application, or they are defects in the plate—mostly this last; for I find one well-known make always has pinholes in my hands, while others are entirely free. The plates are mostly very free from dust as they are packed; but I always give a little tap on a bit of wood as I put in holders, so as to jerk off any possible particles. To brush is to cover with numberless particles, and the brushing sets up an electrical action which causes the dust to adhere strongly.

Again, we are advised to soak a minute or two in water before developing, and brush again to remove air bubbles and allow developer to penetrate. This is bad advice. There are never air bubbles—in my experience—if the developer is flooded on the plate, and the water in film hinders and weakens developer, and prevents penetration.

Again the advice is to pack plates after exposure film to film in the plate boxes, waiting an opportunity to develop. Exposed plates packed film to film fog each other, and if they remain a week or two are spoiled. I have used the brown paper plates are packed in to put between each as I return to plate boxes, and find that all right; but in the case of a hand camera with sheaths, there is a better plan. Obtain a supply of surplus sheaths, and before leaving home put all plates into sheaths, and replace in plate boxes all that are not put in camera. When it is required to change it can be done in any dim light, and the whole dozen exposed are removed at once to an empty box, while the new supply are taken bodily and put in camera. The sheaths thus always remain between the plates until removed in one's own developing room, and effectually protect from mutual fogging, and exposure while changing.

The gelatine printing-out papers now so much in use present difficulties in mounting. If they are mounted wet they stick to almost anything used to press them into contact with the mount and often curl up at the corners as they dry. If they are mounted dry the gelatine swells and blisters, and never goes down evenly after. The remedy is to squeegee every print on to glass to dry; this keeps the gelatine from contracting as it dries and keeps the prints flat also. Then, with stiff starch paste applied to the mount and *not* to the print, the print can be laid in place and a piece of clean paper put over it and then rubbed into close contact. It will now neither blister nor show any tendency to curl off, nor will it curl the mount nor spoil the brilliant surface.

None of these gelatine papers seem to be any more permanent than the old albumen. I always attributed the fading of albumen prints to the use of rotten albumen, and not to either faulty washing or hypo left in the film. Possibly some gelatine may be a little gone when used. The prints anyhow are very uncertain as to their permanency. It appears to me that if we desire permanency we have to choose among carbon platinum bromide and blue prints, and cannot depend on any others. I know prints can be produced of considerable age, but this does not refute my conclusion: they are but a small percentage after two or three years. Alpha paper appears fairly permanent, and plain, salted, silvered paper made at home lasts well—much better than either albumen or gelatine. Are not gelatine papers lightly printed and then developed up to full intensity more permanent than when printed right out? Experiment and experience are the best teachers.

Long Exposure for Portraits.

Franz Lenbach, one of the most successful of the modern portrait painters of Germany, in a recent article on "Photography for the Painter," makes a very strong argument in favor of long exposure on portrait negatives. He takes the ground that the personality and characteristic expression of the sitter may not be truthfully obtained with the extremely rapid, shutter exposure so much in vogue, and that while, of course, there is a limit to the amount of mobility of features, beyond which it is not safe to go, there is, nevertheless, much to be gained by allowing the sitter to know when the exposure is about to be made, that his features may be relaxed and he himself may be at ease. In this way he claims the features gradually assume a state of rest, and that the exposure which has meantime been going on, and which may extend from five to ten seconds, will result in a more satisfactory likeness than if made at high speed.

Prolonged exposure, he says, reduces nervousness, while rapid exposures excite the sitter and increase it. Somewhat the effect of a composite picture of many fleeting phases of expression must naturally follow such treatment as this, and the reasoning seems to us to be perfectly sound. Those who have sat in front of the cameras of some of our own portraitists, and who have as a result of such sittings secured portraits that are distinguished from pictures—likenesses that speak—will be likely to remember that the exposures required were of appreciable duration. As an example of such work we have only to look at some of the strong portraits made by Pirie Macdonald, for instance, who agrees fully with the German authority above quoted.—Anthony's Photo. Bulletin.

Smokeless Flash-Light.

M. Charles Henry has endeavored to keep the magnesia, that is formed, as much as possible attached to a heavy substance that will not easily fly about, and falls soon by its own weight—namely, the binoxid of barium. This substance, at a red heat, gives up half of its oxygen, and its salts communicate to flames a brilliancy of greenish fire, which partially corrects the undue proportion of violet and ultra-violet rays emitted by incandescent magnesia. Finally, the binoxid swells when heated, and becomes capable of retaining the light powder of magnesia formed in contact with it.

The sole condition to be observed, that the binoxid may be reduced with incandescence, is to remove it from all contact with oxygen. To this end, and also to insure the inflammability of the mixture, the powder is done up in collodion, whose products of combustion constitute a reducing atmosphere, adapted to the dissociation of the binoxid of barium at the lowest possible temperature. All the elements of such a powder thus play an active part at the highest point. These powders have besides a great advantage over those made of potassium chlorate; they are absolutely inexplodable by the stroke of a hammer, and are inodorous and without danger from the physiological point of view. M. Henry, we are told, has prepared two types of powder that differ in their proportions of the binoxid—the first, which has only a little magnesium, gives only 45 to 50 per cent. of smoke, whereas ordinary powders give 75 to 90 per cent. The other is richer in magnesium, burns more slowly, and can be used advantageously only in a special lamp, when the proportion of smoke falls as low as 10 per cent., and the brilliancy, owing to the high temperature to which the magnesia is raised, is very great.—Rev. Scientifique.

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A Sultan's Camera

A London firm of photographic apparatus makers, during the sojourn of the Moorish ambassadors, constructed a camera for the Sultan of Morocco at a cost of $10,500. The instrument is of the quarter plate size (3¼ x 4¼) and differs in no respect as regards the fittings from the ordinary camera made by this firm for general purposes. The metal work of the camera is constructed of gold, including the screws, and also the holders for retaining the plates. The instrument occupied the services of ten men for four months, the polishing of the base boards alone requiring many days to accomplish. About 150 ounces of gold have been utilized and the instrument weighs 13 pounds instead of 5 pounds, the weight of the same camera for ordinary use.

It is a combination hand and stand camera with double extension racking out from the center and rising front. It has but one lens, a Zeiss working at *f* 6.3.

Hall's Journal of Health

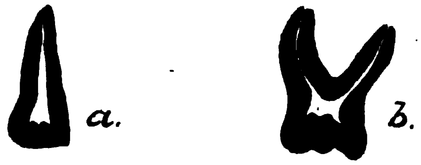
Founded by Dr. Wm. M. Hall, 1854.

ODONTALGIA.

BY M. G. JENISON, M.D.

Toothache, or odontalgia, like other of our pains, is nature's signal of trouble, caused here as in other cases by accident or neglect. Toothache is nearly always the result of the decay termed caries, being the signal of nature that one of the valuable dental organs is being injured and requires attention. As to how this is told it will be necessary to consider briefly the structure of the tooth.

Covering the crown and extending under the border of the gum is the enamel, which is quite hard, being composed of about 95 per cent. lime salts, and practically devoid of sensation. Its purpose being to withstand the force of mastication and to protect the other parts of the tooth.



A. SINGLE TOOTH. B. DOUBLE TOOTH.

Next within is the dentine, composed of about 72 per cent. lime salts and 28 of organic substance. This breaks down much more rapidly than the enamel when affected with caries. It is also quite sensitive, the most sensitive portion often being where it joins the enamel.

The central portion of the tooth is occupied by the pulp, or nerve, as it is commonly called. The cavity occupied by this formative organ of the tooth is quite large in childhood, but usually decreases as age advances until in extreme old age it is frequently entirely obliterated by a deposit of lime salts or secondary dentine. The pulp is composed of blood vessels, nerve fibers and connective tissue. When irritation occurs inflammation ensues, the distended blood vessels press upon the nerve filaments and we have toothache. In the more aggravated forms the pulsations of the artery gives what is called the jumping toothache, which will destroy any one's peace of mind about as completely as any of the ordinary pains we are called upon to experience.

The apical foramen or opening at the end of the root is very small, and when the inflammation is sufficient, strangulation ensues and we have death of the pulp. Decomposition usually follows, and the septic matter passing through the apical foramen produces inflamation of the membranes surrounding the root, and if it progresses, terminates in an abscess; if this is neglected it may produce very serious results.

The general object sought for in the treatment of the aching pulp is to remove the irritation and inflammation, but when the pulp dies either from neglect or from medicines applied for that purpose, it should, under antiseptic precautions, be thoroughly removed. If this is accomplished no harm results. If it is not, peridontitis and abscess result.

Although caries is the most common cause of toothache, it is not the only cause, the diagnosis being in some cases quite difficult, as the cause may be located far from where the pain is manifest, or it may be constitutional, in which cases local treatment of the tooth would not relieve the trouble.

Either through ignorance or impatience many a tooth is sacrificed for these obscure causes. In either case the action cannot be too strongly censured.

The subject of reflex pain is an interesting one, the origin in many cases being quite difficult of diagnosis. As manifested in the teeth, the cause of irritation may be located in a tooth which is apparently comfortable, while all the pain is felt in another tooth without any apparent cause for it. The trouble may be all in the teeth of one jaw, or the origin may be located in one jaw and the manifestation be altogether in the teeth of the opposite one.

Growths pressing upon the nerves sometimes cause pain in the teeth, even when the origin is remote from them and where no disturbance is apparent at the point of origin.

The study of the nerves is extremely interesting, for when we consider the subject as a whole it takes us to the question of our vital existence. Just what is nerve force is to a certain degree theoretical, but the conclusions arrived at from the manifestations are deemed sufficient.

That form of sensation which we call pain is naturally avoided by all whenever possible, but, when we consider how much trouble we are kept out of by the thought of the pain which would ensue from a certain action, we can but think pain is really a friend viewed from the sense or physical standpoint. It tells man that some part of the bodily organism is out of order, and urges assistance and reparation.

It is hard to realize, when pain is manifested in any particular locality, that all the sensation is in the nerve centers of the brain, to which the nerves have carried a return message from the affected locality, notifying us of the trouble; and we speak of it as pain at the affected point.

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Bees for Rheumatism.

Some years ago an Austrian physician advanced the theory that the virus of the bee sting is an infallible remedy for acute rheumatism, a fact that receives unquestionable confirmation from a custom of the country people in Malta. Bees are plenty in this island, and their stings in such repute that resort to this method of inoculation has been a common practice.

Treatment of Colds.

In the first place it is well to remark that, "taken in time," a cold in the head can assuredly be checked. Left to itself to proceed beyond a certain, and we may add, very early stage, it must "run its course." We can then only modify that course, and cause the symptoms to be less severe, by means of appropriate treatment. In the earliest stage a warm hip or foot bath, and a large opiate (Dover's powder, especially) at bedtime, if followed by confinement to the house, and, in severe cases, to bed or to the sofa for a day or two, light farinaceous diet, and if the general system is at all loaded, a dose or two of some gentle laxative, will generally cut short the disease. There is no cutting it short by abortive treatment, any more than we can stay the progress of typhoid fever, or cause scarlet fever or measles to terminate its action.

If the cold has become established, we can only endeavor to mitigate the severity of its symptoms. The remedies recommended for this purpose are "legion." In some persons it yields readily to spirit of camphor (five drops on a lump of sugar every half hour), but in others no effect is produced. Spirit of camphor sprinkled on the handkerchief and the vapor inhaled will also often afford great relief—in checking the "running" from the nose and the inevitable sneezing.

Turpentine as an Antiseptic.

Dr. Kossobudsk has used glycerinated turpentine in the antiseptic treatment of wounds with marked success. The author's mode of preparing the liquid is to fill a sterilized bottle with glycerin and add a small quantity of turpentine, shake well and repeatedly, and let stand for two days; then add 5 per cent. of hydrogen peroxide. The mixture is now ready for use, and the author considers it very valuable as an antiseptic. It checks excessive secretion when applied to wounds, relieves pain and swelling, and promotes the healing process. This action is probably due partly to the oxygen liberated, partly to the chemotactic properties of the turpentine.—Med. Record.pd.

Liquid Peptonized Beef.

The outlines of a process for making a liquid peptonized beef would be somewhat as follows: Chop a suitable quantity of lean beef very fine, and macerate it for 6 hours or so in a solution of pepsin in water acidulated with hydrochloric acid at about 100° F. The mixture is then strained, and neutralized by sodium bicarbonate, and a small quantity of pancreatic extract added. Suitable corrigents, such as port wine, sherry, or elixirs, may be then added, with perhaps some saccharin, in order to impart an agreeable taste or flavor to the preparation. The exact quantities of the various ingredients should be readily determined by making a few experiments and carefully testing its keeping qualities.—Practical Druggist.

Various Topics

SOLAR AND SIDEREAL TIME.

BY ARTHUR K. BARTLETT.

It is a fact not generally known that, owing to the difference between solar and sidereal time, the earth annually rotates upon its axis once more than there are days in the year. The earth performs one complete revolution upon its axis in 23 hours, 56 minutes, and 4.09 seconds of solar time. This is called a "sidereal day," because in that time the stars appear to complete one revolution around the earth. But, as the earth advances almost a degree eastward in its orbit, in the time that it turns eastward around its axis, it is easy to undertand that just one rotation never brings the same meridian around from the sun to the sun again; so that the earth requires as much more than one complete revolution upon its axis to complete a "solar day" as it has gone forward in that time. It will be obvious, therefore, that in every natural or solar day, the earth performs one complete revolution upon its axis, and the 365th part of another revolution. Consequently, in 365 days, the earth turns 366 times upon its axis; and as every revolution of the earth upon its axis completes a "sidereal day," there must be 366 sidereal days in a year.

The same considerations will apply to our neighbor worlds of the solar system, and since the rotation of any planet upon its axis is the length of a sidereal day at that planet, the number of sidereal days will always exceed the number of solar days by one, let that number be what it may, one revolution being always lost in the course of an annual revolution. This difference between the solar and sidereal days may be illustrated by referring to a watch or clock. When both hands set out together, at 12 o'clock for instance, the minute hand must travel more than a whole circle before it will overtake the hour hand, that is, before they will again come into conjunction.

As the star-sphere turns a little more than once around in 24 hours, if we observe the heavens night after night at the same time, we shall notice precisely the same kind of change as when we look at the heavens hour after hour on the same night. If we look at the stars at 10 o'clock on any night and note their position, and we again note the position of the stars at 11 o'clock on the same night; then, if afterwards we examine the stars night after night at 10 o'clock, we shall find that at the end of about 15 days they have at this hour the same position that they had on the first night at 11 o'clock—that is, they have advanced by just one hour's motion. In a month or thereabouts, they will be found to have advanced by two hours' motion. In a year they advance by 24 hours' motion—that is, by one complete rotation—so that they have resumed their original positions; and this fact explains why, in the course of a year, the star-sphere (in reality the earth) turns around once oftener than there are days in the year, or 366 times.

The late Professor Proctor, in a very instructive article on "How to Learn the Stars," says: "The amount by which the stars have advanced each night on the position they held at the same hour on the preceding night is by no means so small as is, perhaps, commonly imagined. This may be easily tested. Let there be an upright of any sort a few yards to the north of the observer's station, and let him notice the exact hour when a star (at a fair height above the horizon) appears from behind the edge of this upright. At this hour on the next night he will find that, as seen from the same station, the star is about two moon's breadths past the upright's edge. The observer should look through a fixed tube placed in the same position on each night."

The rotation of the earth determines the length of the day, and may be regarded as one of the most important elements in astronomical science. It serves as a universal measure of time, and forms the standard of comparison for the revolutions of the celestial bodies, for all ages, past and to come. As a recent writer has well remarked, "theory and observation concur in proving, that among the innumerable vicissitudes that prevail throughout creation, the period of the earth's diurnal rotation is immutable." This statement is not strictly correct and needs to be qualified somewhat in the light of some recent discoveries regarding tidal action and its effects in retarding the earth's rotation, but except from this cause, which is very slow and hardly noticeable in its operation, the length of the sidereal day has not varied as much as the one-hundreth of a second during the last two thousand years. At present we can only say that the change, if any change has occurred since astronomy became an exact science, has been too small to be detected, and as Professor Young remarks, "Probably it has not changed by the one-thousandth part of a second, though of that we can hardly be sure."

Battle Creek, Mich.

Average Length of Life.

We are rapidly gaining in the average length of human life. Better sanitation, the enforcement of precautions against contagious and infectious diseases, and the advancement of surgery and medicine, are causing an even more rapid reduction of the death rate than the laymen guess. The census bulletin of deaths that occurred in 271 cities of 5,000 population or more shows that 18.6 persons died in 1900 out of every 1,000, whereas in 1890 the number who died in the sams cities was 21 out of every 1,000.

COLORADO FLOOD WATER WASTED.

BY H. A. CRAFTS.

There is a theory quite generally accepted, that the water supply of Colorado east of the Rocky Mountains has all been appropriated. If this theory were applied to the normal supply it would no doubt be true. But what about the abnormal supply? The records of the flow of the Poudre for last spring, and for the spring of 1900, if carefully examined, would seem to show that a very large amount of water went to waste.

CACHE LA POUDRE FLOOD, MAY 22, 1901.

No doubt the records of other streams would show a like state of affairs. Looking farther back in the history of irrigation in the state, instances are not lacking where vast quantities of water have been lost. Take the season of 1884. The normal average flow of the Cache la Poudre river is about 500 cubic feet of water per second. In the year named the river during the season of high water showed a maximum flow of 7,000 cubic feet per second. The carrying capacity of all the irrigating ditches on the river is in the aggregate about 2,400 cubic feet of water per second. During the season of 1884 there were twenty days when the discharge of the river was 5,000 cubic feet per second, and fifty-five days when the discharge was 3,000 cubic feet per second.

Now, even if all of the ditches had been running to their full capacity they could not have handled more than two-thirds of this amount of water. But there were times when they were running only a part full, or not at all. Computing a surplusage of 2,500 cubic feet per second for the twenty days mentioned, and of 1,000 cubic feet per second for the balance of the fifth-five days, and we have the immense aggregate of 7,344,000,000 cubic feet of water that went to waste. Reducing this to acre feet and we have 168.595, the number of acres that might have been irrigated for a whole season with the water that was forever lost.

The records of the past two seasons are even more instructive. April, 1900, was marked by a prolonged rainfall; May, 1901, was marked by sudden storms of great severity, accompanied by destructive floods. The rainfall at Fort Collins for the month of April, 1900, was 10.56 inches, as against a normal fall of 2.12 inches. The discharge of the river for that month was an average of 2,900 cubic feet per second, or more than five times the normal. April under normal conditions is not a month for irrigation, as crops do not attain a sufficient growth to require it. But even if crops had been up, it can readily be seen that with a rainfall of more than ten and a half inches, irrigation would have been entirely superfluous. So it will be seen that a vast amount of water went to waste during the month of April, to say nothing of the flow for the succeeding month of May which was also far above the normal.

Coming down to May, 1901, we find a record of rainfall at Fort Collins for the month of 7.47 inches, while the normal is 2.74 inches. Of this amount 5.60 inches fell on the 20th and 21st. The storm of the 21st was heavier in the mountains and caused a rise in the Poudre of 7.46 feet, and an estimated flow of 12,000 cubic feet of water per second. The average flow of the river for the twenty-second was 5,100 cubic feet per second, while the normal for that day is 1,547 cubic feet per second. This caused the river to leave its banks, flooding immense areas of bottom lands and doing much damage. Nearly all the ditches were damaged by the floods and had to be shut down, so the whole vast volume of water was confined within the capacity of the river for discharge.

Some might suppose that a part of this extra flow of water might be utilized in filling the various storage reservoirs owned by different ditch companies. Possibly a small percentage could be thus utilized, but the fact of the matter is that the reservoirs are filled largely during the fall and winter, and can receive but small amounts during the spring.

Now as a further illustration let us compute the amount of water discharged by the river during April, 1900. This aggregates in cubic feet 7,516,800,000, or about 170,000 acre feet. This would be enough to irrigate for an entire season, every acre under cultivation in the Poudre Valley.

The question of saving this surplus water has been discussed, but not extensively agitated. The irrigation companies already in existence have figured but little beyond securing the normal supply. A number of them have constructed storage reservoirs, but have provided no means of filling them outside of their main irrigating canals. The Terry Lake reservoir, just north of this city and owned by the Larimer & Weld ditch company, to be sure, is filled through an independent ditch, but this is of a small carrying capacity and the reservoir is filled by slow process.

The plan suggested for the controlling of flood water is the construction of a series of reservoirs as near the river as practicable, and to fill them by means of very large supply canals, and to have a sufficient number of canals to receive at once the flow of the largest flood. As these reservoirs would be constructed on the plains the work would be comparatively inexpensive, as it would consist almost exclusively of earth work. They could be located all up and down the river on either side, so that no matter how sudden or excessive the floods were, the great bulk of the water arising therefrom could be impounded.

Several sites for reservoirs of this kind have been prospected in this valley. One of the principal ones is Boyd's Lake, between Fort Collins and Loveland. This could, it is said, be enlarged by a certain amount of diking to hold an immense quantity of water. It is proposed to construct supply canals from thirty to forty feet wide and from eight to ten feet deep. Plans have also been suggested whereby a combination might be made with some of the already existing ditches, enlarging their capacity so as to handle the flood waters and convey it into storage reservoirs.

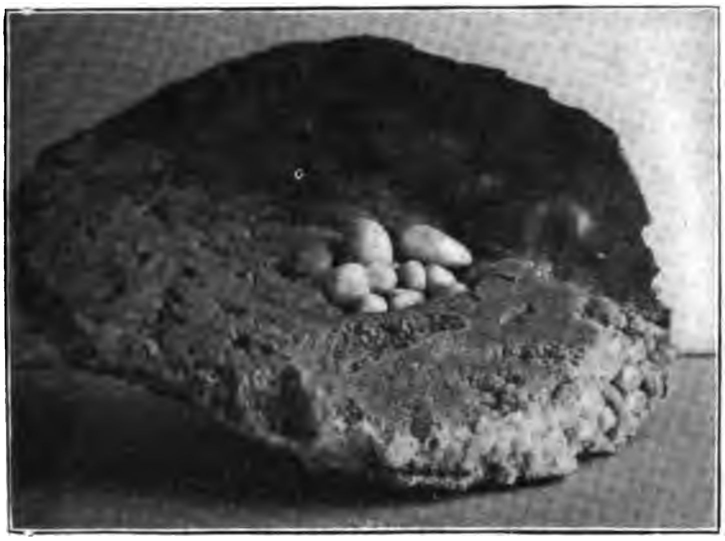
Capital thus far has not cared to embark in irrigating enterprises that did not promise immediate results upon completion of construction, and annual profits thereafter. But in view of the money value of every cubic foot of water available for irrigation in Colorado, it will not be long before a beginning is made in the institution of this new system. The fact that large excesses of water have been seen in two successive seasons, suggests the greater feasibility of the scheme.

There would seem to be favorable locations for flood reservoirs in other sections of the country. During the present season vast volumes of water have flowed down the smaller streams, in this vicinity, such as Fossil Creek to the south and the Box Elder to the north. Taken all in all, there are presented opportunities for some very fine feats of irrigation engineering, and a large increase of our farming areas.

BIRD'S NEST CALCITE.

BY SAMUEL HOLDEN.

Calcite, or "calc-spar," as it is popularly known, is a mineral which has, with the exception of quartz, more varieties than any other species. Of these varieties, Mexican onyx, Iceland spar, the stalactites of caves, etc., are familiar to all. Most of the specimens of calcite found are beautiful, often forming splendid groups of crystals (of the rhombohedral system, as known to crystallographers); and many are the famous localities where interesting examples of this mineral are encountered.



BIRD'S NEST CALCITE.

Chemically considered, calcite is calcium carbonate (carbonate of lime), and effervesces strongly when placed in muriatic acid, due to the liberation of carbon dioxide, an invisible gas. And this test with acid, together with its crystalline form, cleavage, degree of hardness, etc., usually enables the mineralogist to readily distinguish it from other minerals.

The specimen shown in the illustration is known as "Bird's Nest Calcite," from its resemblance to the nest of a bird, containing eggs. The writer obtained it from a dealer in minerals, who imported it from Reichelsdorf, in Hesse, Germany, where it was found. It is entirely of mineral origin, having been formed in nature by the deposition of the calcium carbonate, which had been held in solution by the waters of the hot springs of Reichelsdorf, and which they could not retain after issuing from the earth into the open air, because of evaporation and the release from pressure.

The nest is about seven inches in diameter, and is a light yellow-brown in color. As this color photographs rather dark, the specimen appears somewhat darker in the illustration than it is in reality. The structure of the upper side is rather porous and friable. It sparkles somewhat in the light, as many of the grains show smooth little surfaces (due to cleavage), which reflect the light.

The top is slightly concave. A little to one side of the centre is a cavity, or depression, which is quite deep, and contains the "eggs," as the little concretionary calcite pebbles are called. There are about thirty-three of these, ranging from the size of a small pea to nearly three-quarters of an inch in length; and with a few exceptions they are not attached to the nest, but lie loosely piled together. Some are almost spherical in shape, while others are long and flattened. Their color may be described as milky, some having a light brown tint.

Upon grinding down one of these "eggs," so as to reveal the internal structure, it was found to consist of a series of concentric but irregular circles, showing that the structure was concretionary; that is, there was a first nucleus, which may have been a fine grain of sand, or almost anything held in suspension by the waters of the hot springs; then, around this nucleus was deposited a thin layer of calcite from the waters, which were, as previously stated, unable to retain it in solution after their release from pressure. After this, layer upon layer was deposited, until the "egg" was completed. Upon the shape of the nucleus and, also, upon the manner in which the calcite was deposited around the nucleus, would depend the shape of the finished "egg," thus accounting for the fact that some are nearly spherical, while others are more or less elongated.

It must not be imagined that this mineral is an exact reproduction of the nest of a bird. By no means. Neither is it a "petrified bird's nest." But the form is near enough in general characters to merit the name bestowed upon it, that of Bird's Nest Calcite.

It is such specimens as this one, which so well illustrates the imitative forms sometimes taken by minerals, as well as other specimens much more curious and interesting, that add to the interest of mineralogy, and hold the attention of those who study it either from the standpoint of the lover of nature, to whom all that is odd or beautiful appeals, or that of the patient scientist, who seeks to unravel the knotty problems constantly presenting themselves. The latter, however, finds all minerals instructive and interesting, whether beautiful or otherwise.

THE LEAST BITTERN.

BY C. WILLIAM GROSS.

The Least Bittern (Ardetta exilis) is generally spoken of as a southern species, yet a few years ago I found them nesting in several Minnesota lakes. At Bald Eagle Lake in particular they could be found in numbers among the shallow, reedy bays.

They live where the reeds are thickest, and keep strictly away from open water. The nest is a clumsy affair of rushes and rank vegetation, and so flat that a person wonders why the first small wave does not roll the eggs into the water.

The nest is fastened in a thick bunch of rushes or cat-tails and is very hard to find. I have found the nests of the Least Bittern, the American Bittern, and the Yellow-Headed Blackbird in the same clump not two feet from each other.

Most of the nests I found contained four eggs, and a few only three. The eggs are of a clear white color and rather large for the size of the bird. I am of the opinion that this bird raises two broods a year, as I have found nests containing eggs as late as July 28th, but I have no other proof. The young remain in the nest until full fledged, and are fed by parents.

The food of this Bittern, like the other species, consists of small fish and aquatic insects. The bird feeds chiefly at night and if disturbed it keeps quiet and slinks away among the thick reeds. Even in the day time they fly but a short distance, and then drop quickly among the weeds. After being frightened once, it is almost impossible to get them on the wing a second time; they prefer to remain quietly hidden in some bunch of dead rushes, where everything is about the color of their plumage.

They leave here for the south about the first of October.

St. Paul Public Library.

Dimmed Eyeglasses.

Every wearer of eyeglasses has noticed how they become dim with moisture when subjected to a sudden change of temperature—as, for instance, when the wearer goes from the cold outer air into a warm room. The reason is, of course, that the cold glass causes a condensation of the vapor with which the warm air is laden, and thus becomes coated with little globules of water. A German scientific paper says that this may be prevented by rubbing the glasses with soft potash soap every morning. They may be polished bright after the soap is applied, but an invisible film is left on them that will prevent the deposit of moisture.—Can. Drug.

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TO OUR READERS.

With the opening of another year, we congratulate our readers and ourselves on a staff of able contributors, with new ones of merit from time to time. And we are gratified by private letters received from intelligent sources, commending strongly our journal and its improvements, including the mechanical and illustrative.

Beginning with this volume we have adopted a design for the outside cover. This was selected from a great many that were submitted, and we hope our readers will be pleased with the change, and agree that an improved appearance adds to the attractiveness of our publication. It is our aim to make it all it should be. It circulates in every State and Territory of our country, and its articles are representative of the wide continent, including our extreme West and South, and neighbor Canada, where we have valued friends. Abroad as well as at home our articles are frequently copied, especially in England, and by translations in France and other lands.

Another reason for felicitation is the long life of this periodical,—now in its thirty-sixth year. It was originally the Boston Journal of Chemistry, but, in its gradually expanding scope, took the name of POPULAR SCIENCE NEWS. It has absorbed numerous science periodicals, which, it may be added, indicated a growing interest in the knowledge of Nature. Along with this indication, there is a great development of nature study in schools throughout the land, ministered to by some of the publications issued by universities, agricultural stations and the general government. It was high time that this country came to the support of journals for the people, covering a part or all of the field of science. Our much educated nation should abundantly sustain a journal that is devoted to the advancement of science.

THE HEAVENS FOR JANUARY.

BY PROF. MALCOLM McNEILL.

Readers of this column of POPULAR SCIENCE NEWS may perhaps think that it is hardly worth while to repeat year after year the paragraph giving the most prominent constellations visible for the month. What answers for January, 1902, was equally as good for January, 1900, and will be about as pertinent for January, 2,000. Except for the excessively slow changes due to precession and proper motion, the January sky for this year is like the January sky for any other year. The Wandering Jew sees the same configurations now that he saw as a boy at the beginning of our era. The only difference is they are for any given time of year about a month later than they were when Christ was born. The present January sky was then the December sky.

But many readers like to read about things they know already, others forget and do not object to having their memories jogged, while new relays of readers come in year by year, so that it may not be amiss to say a few words each month even if they differ little from those of a year ago.

Auriga is in the zenith, and Pegasus, Cassiopeia, Perseus and Andromeda are in the northwest quarter of the heavens on January evenings. Taurus is high up a little west of the meridian; and Gemini, Cancer and Leo extend from the meridian to the eastern horizon. Orion, with his attendants the greater and lesser dogs, is in the southeast quarter, while Ursa Major is in the northeast.

But the case of the planets is far different from that of the fixed stars. No man has ever twice seen the same configuration, nor would he, should he live a thousand years. Therefore, he who wishes to find them must consult an almanac, or some substitute for one like this article:

Phases of the Moon, Eastern time:

Last Quarter,	Jan.	1,	11 h.	8 m. A.M.
New Moon.	"	9,	4 h.	15 m. P.M.
First Quarter,	"	17,	1 h.	38 m. A.M.
Full Moon,	"	23,	7 h.	6 m. P.M.

January evenings, this year, do not give favorable opportunities for seeing many of the planets, but Mercury and Venus are in good position.

Mercury passes superior conjunction with the sun on the night of Jan. 1, and becomes an evening star, but does not get far enough away to be easily seen until after the middle of the month. For several weeks it will remain above the horizon an hour or more after sunset, and at the time of greatest eastern elongation, Feb. 3, it will not set until about an hour and a half after the sun. It passes Saturn on Jan. 6, Jupiter on Jan. 9, and Mars on Jan. 23. The planets are too near the sun for the first two conjunctions to be easily observed, but the last can be seen although Mars will be rather faint. It is quite a close one. Mercury will be less than the moon's diameter south of Mars.

Venus is pre-eminently the evening star, remaining above the horizon three hours and a half after sunset on January 1, and about two hours on January 31. It is at its greatest brightness on January 9, and will be visible to the naked eye in full sunlight throughout the month. It passed its greatest apparent distance from the sun on December 4, and the gap is closing up, although the eastward motion of the planet among the stars continues until January 22. Seen in the telescope Venus will now present the appearance of the moon when only a few days old. Mercury, on the other hand, will have the shape of the moon when between half and full.

Mars is still in the southwestern sky just after sunset, but has for some time ceased to be conspicuous. On January 1 it remains above the horizon about an hour and a half after sunset. On account, however, of it low altitude and faintness it can not be easily seen.

Jupiter and Saturn are still near together, but the eastward motion of the sun among the stars is so much greater than that of the planets, that it overtakes and passes them, Saturn on January 9, and Jupiter on January 15. These planets then become morning stars, but not until the middle of the next month are they far enough from the sun to be easily visible. The distance apart of the planets increases from 4° to 6° during the month.

Uranus passed conjunction with the sun early in December, and is now to be found in the east before sunrise, but is rather too low down to be readily seen. It is between the constellations Scorpio and Sagittarius.

Neptune is above the horizon the greater part of the night. It is in the region between Taurus and Gemini, but can not be seen without a telescope.

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Motions of the New Star in Perseus.

Besides the remarkable nebula recently discovered, surrounding this star, it is reported that there is a rapid movement. The average displacement of first-magnitude stars, in whose position any alteration has been detected, is one fourth of a second a year. That of Arcturus is two seconds, while the largest 'proper motion' yet noticed is about eight. Now, the change observed on Mount Hamilton is more than a minute in six weeks, or at least seventy times as great as any hitherto observed in objects beyond the solar system. Measurements of this kind can not be converted into miles without some estimate of the distance of a star from the earth. In a few cases, however, the astronomers have secured evidences of velocities of hundreds of miles a second! The recent movement of Nova Persei, therefore, if real, might have been between five thousand and fifty thousand miles a second, a speed that the boldest imagination can scarcely grasp. The calculations await further revision.

MARVELOUS ARCTIC REFRACTION.

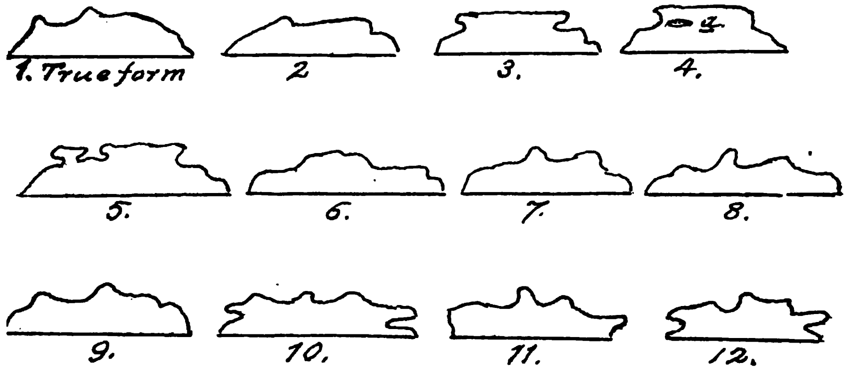
BY G. W. HARVEY, M.D.

Where is the individual who has not been astonished at the wonderful and realistic effects of a mirage? I well remember the amazement with which I beheld, when a boy, a whole village, a steam thresher in operation with its crew and stacks of grain near by, suspended in the air upside down. It was during a morning when heavy fog had settled down for a time and then partly lifted and cleared. The distant sounds, also, were wondrously reflected. I could hear the hum and whir of the thresher, the exhaust of the engine and the men shouting to each other as plainly as though they were within twenty feet of me, yet I knew that they were at least three miles away.

I had long since given up the idea of ever again beholding anything in the phenomena of mirage so wonderful, but fortunately I was permitted, on a voyage to the Arctic, to behold a far more astonishing manifestation of mirage effects, since there was a constant change of the images. We were anchored in Norton Sound, Alaska, and about twelve or fourteen miles from land. To the south and west of us was a low range of mountains stretching back and up from the Sound to various altitudes, but in no case reaching a greater height than fifteen hundred feet. The summit of this range was about eighteen or twenty miles from our good ship, and of a smooth contour, but falling off into wide stretches of subjacent declivities that united one peak to the other. It was shortly after dinner, while promenading with a friend, that I first noticed a mountain in front of me assume a different shape from that of its accustomed outline. I rubbed my eyes and looked again. It was even so, the mountain was in motion and changing its outline rapidly. Was my visual apparatus playing me tricks, or my mind in that peculiar condition of disease wherein one seemingly sees all manner of fantastic and changing forms?

I began to look about me. There were no clouds within twenty degrees of the horizon. There was no haze either; not even in the dim distance, and all the atmospheric conditions were seemingly most unfavorable for mirage effects; yet every mountain in the range to the south and west of our ship seemed vying with each other in this tableau fantoccini of nature.

One of the most striking reproductions of this mimicry was that of a revolving and disappearing double gun-turret and its ordnance. The round turret would come slowly up out of the summit of the mountain, and when a proper height was reached a gun would be thrust from its side and then as suddenly withdrawn. It might reappear in a moment or the gun on the opposite side be thrust out. Again they would be run out from both sides simultaneously, to be withdrawn in succession. After this realistic gun-play the turret would slowly settle back within the mountain top to reappear in a few moments in another role. Perhaps upon its next appearance there would be but one gun used. This would be run out from the turret's side, and instead of being withdrawn as in the former play the turret would swing half around instantly with gun in position. One could hardly escape the idea that there was a mighty battle being fought with heavy artillery. The only thing lacking to make it decidedly real, was some smoke and thunder.



ARCTIC MIRAGE EFFECTS. *a.* A LAKE.

One other spectre was that of a volcano, and what made it all the more vivid was the fact that in coming through the Aleutian Islands we had seen two smoking mountain cones. This spectral volcano came slowly up from the mountain top and assumed a truncated form, then a red spot appeared in its center, which gradually developed into a lurid glow and spread until one side of the cone was seemingly melted off and ran down the side leaving the other intact.

Another apparition was that of a tunnel which would appear in the body of some mountain. This would be slowly cut upward from its base until it became an open cut or canal, which widened until part of the mountain became an island that grew smaller and smaller until it vanished seemingly in the dim distance. Again a number of tunnels would appear simultaneously and gradually coalesce, imparting the impression that this part of the mountain was being mined away or that a gigantic excavating machine was opening a road.

Another pleasing phantom was effected by the mountain raising itself into a lofty and rugged eminence, with a wide-spreading treeless plateau reaching out from one side, which presently became clothed with a luxuriant forest of great and small trees.

Another phasma was presented by a number of the mountains raising themselves into lofty heights separately, and then running together or fusing into one huge unbroken wall, perfectly flat on top. In a little time a triangular opening appeared in the wall, with its base upward. This opening widened and spread until the wall assumed an hour-glass shape, that finally separated into two cones, one of which arose and floated off into space while the other one settled into the earth and disappeared.

I have given you but a few of the multitude of these wonderful refractive transmutations, for intermixed with these most notable ones were all manner of images such as huge mounted cannon, gigantic clubs raised by invisible hands, captive balloons, cocks of hay, domes, towers, palisades, pyramids and obelisks, giants in acrobatic contortion, immense stairways reaching upwards to invisible mansions, anvils equal to the hammer of Cyclops, lakes and tarns of great beauty, tops, toadstools, bottles, tumblers and thousands of other forms so numerous and fantastic that one could easily imagine himself a beholder upon the day of creation when all things of earth were plastic, and being modeled and given shapes and forms as best pleased Him whose power and wisdom fashioned the universe.

The crowning effort of all this phantasmagorical display was the deadly swoop and rending struggle of a mighty bird of prey. The mountain in front of us reared itself into a slender pinnacle, which began to narrow in at about its upper fourth until a complete separation took place. The upper piece assumed in the course of a few moments the outlines of an immense eagle or roc, which hovered threateningly over the rapidly settling pinnacle until the mountain had assumed almost its natural contour, when it swooped and seemingly struggled for a moment with its prey, or until the apparition had passed from the image back to reality.

The accompanying diagrams are some changes noted in Brisbane Island, which lay some sixty miles to the north of us, on the evening following. These all occurred within an hour. I learned afterwards in conversation with people who have spent many summers in the Arctic that such marvellous displays as I had beheld were of common occurrence in June, almost anywhere in the Bering Sea.

Balloons as Aids in Travelling.

A suggestion made by the aeronaut Wise as long ago as 1850 is worthy of the 20th century. He proposed that explorers tie to themselves balloons almost lifting their weight, and pointed out that they could then easily travel with the wind by bounds of 100 yards or more, thus crossing swamps and streams.

Correspondence

Story of Hidden Treasure in the West.

Editor POPULAR SCIENCE NEWS:

Why is mankind mineral mad? Why will men,—intelligent, level-headed, otherwise sane, go wild over rumors of mineral finds and believe implicitly the most exaggerated tale? Why will business men of more than ordinary common sense invest hard earned cash in the most visionary schemes, provided said scheme contains the magic word "mineral?"

Perhaps no one has better opportunity of observing this trait of human nature than has the itinerant geologist. In his rapid work across the country, rarely remaining in one neighborhood longer than a few days and never long enough to get acquainted, he comes into contact with all sorts and conditions of men. Comparatively few understand the nature of his work. The idea that any one should even care to examine the rocks is a thing not merely strange and wonderful but often incomprehensible. The common mind seems to reason thus: "The hills and rocks have always been here, and so far as we know will always be here. Why then should any one go to so much trouble in examining them? This man who calls himself a geologist and who is climbing around over the hills pounding rocks does not spend his time and money for nothing. There must be something back of all this. He is looking for something valuable. Obviously mineral; or maybe hidden treasure. So I'll watch him."

This he proceeds to do. Many a day have I been accompanied on my tramps over the hills by well meaning but suspicious individuals who, while pretending to be anxious to assist me, were really burning with anxiety to find out what I could possibly be looking for. Explanations are of no avail. Instead of clearing up the difficulty they seem to add to the confusion. Again and again have I been warned not to enter a certain piece of ground. "Don't want no body prospectin' 'round here." So not infrequently have I been obliged to abandon at least temporarily good collecting localities on account of what seemed the unreasoning prejudice of the natives.

It was not until I had spent several years in the field that I began to realize that back of much of this opposition and misconception was a common cause. It seems to be based upon a story or perhaps I should say tradition of hidden treasure that is common in the west. Where this story came from, or how it came, I do not even pretend to know. All I do know is that it is almost omnipresent all over the west and particularly in the region between the Rio Grande and the Missouri. Neither is it confined to any one locality or any one state, but may be found in nearly every community throughout the region. I have heard the story in one of its many forms in dozens, not to say hundreds, of localities.

The version of the story varies with the locality. I shall give the most common version that has come to my notice and afterward some of the local variations. These will show that while traceable to a common origin, still the story varies with narrator and place. It must be remembered that the scene of the story is always laid in the particular neighborhood where the narrator resides. The story is as follows:

In an early day a company of Mexicans had been north digging gold. As they were returning home with 40 jack (burro) loads of the metal they were attacked by the Indians. Knowing they would all be killed they buried the treasure. The Indians massacred all of the party but two boys who happened to be away at a spring getting water. These boys escaped and having first placed upon the stones and trees certain marks in order to locate the spot, managed to make their way back to Mexico. Many years afterward one of these boys, then an old man, came through the country trying to find the place where the treasure was buried. But although he could identify the general locality he was not able to locate the exact spot, which still remains unknown.

This is the story: now the variations. Sometimes the gold diggers instead of being Mexicans were Spaniards, again they were Indians, and in one or two instances were early United States explorers or even cavalrymen. Ordinarily they were returning from the north (where in all the north can gold be found?) to Mexico, but not infrequently the party was carrying gold from Mexico to St. Louis. While 40 jack loads seems to be a favorite number, the story sometimes has it 16, 10 or even 7 loads. On one occasion the gold was carried in ox carts, and again on ponies. The Indians attacking were usually Cheyennes, but sometimes Osages or Comanches. One version has it that the Spaniards killed the Americans.

The hiding places of the treasure vary greatly. Perhaps the most common is a cave. Not infrequently, however, it is said to have been buried in a spring, in a running stream, under a flat rock, or in a hollow tree. In one instance it was concealed under two large flat rocks set up on edge like the roof of a house. Instead of two boys escaping it is often two Mexican women. Sometimes one of the men, who was scalped and left for dead, revives and finally recovers. Once it was a scout who was in advance of the party that escaped. Some one always comes back to tell the tale, but not quite find the treasure.

These, then, are a few of the many variations of the story. It is safe to say that there is scarcely a county in Kansas, Oklahoma or Texas where some version of the tale is not told—and believed. In many communities may be found men who implicitly believe the story and who have thought upon it till they have practically become monomaniacs. Scarcely a month passes that the local press does not contain notices of treasure hunting and great wealth about to be found. In some instances I have personally known of hundreds of dollars having been spent in vain search for fancied treasure in a single spring or stream.

The story has crept into the literature of the west. Articles and books have been written about it. One of the most entertaining tales of pioneer days on the Plains has as a basis the tradition I have just related. The book is entitled, "A Fortune Hunter or the Old Stone Correl, a tale of the Santa Fe Trail." The author John D. Carter is now editing a paper at Augusta, Oklahoma. In this story the treasure is buried on the Cottonwood river in what is now Marion County, Kansas.

Whether or not there is rational foundation for these traditions we may perhaps never have opportunity of knowing. It cannot be doubted that many parties of white men,—Spaniards, Mexicans and Americans, have at various times been massacred by the Indians. But that any of these parties ever carried any quantity of gold or any other treasure remains to be proven. To my way of thinking the best way to dispose of all these stories is to attribute them to the credulity of the human race, and again ask the question, "Why is mankind mineral mad?"

University of Oklahoma. C. N. GOULD.

Costume Deformities.

Editor POPULAR SCIENCE NEWS:

Are induced deformities understood? The injury to the full shape of the neck which comes from clothing is seen in the long thin neck, with weak muscles and slight subcutaneous adipose tissue which results from the binding of the neck by collars, stocks and neck bands. The injurious effect of clothing upon the shoulders is seen when the full development of the muscles is prevented and the shoulders are pulled forward, producing the common round shoulder deformity. The pressure of the upper part of a loose waist pulled down by hose-supporters attached to the front, and by the weight of the skirts tends to cause a flattening of the chest. The most important injury to the figure from clothing is seen in the trunk and is the result of wearing corsets. In cases in which corsets or stiffened waists have been worn constantly since early youth, the injury to the structure of the subcutaneous tissue, to the strength of the surface muscles and to the contour of the trunk is so marked as to deserve the term destructive. Bradford says that from investigation it appears that exaggerated fulness of the hips, disproportional leanness of the legs and lower thighs, the flattened chest, the narrow waist, and the long neck, are costume deformities. D.

Wild Flowers of Iowa.

Editor POPULAR SCIENCE NEWS:

Southwestern Iowa is a rolling prairie, not at all like the wide expanse of level prairie, like a green sea, further west; but more like the sea in time of storm when it rolls away in huge billows. The billows become hills, quite steep at times, while others rise more gradually. But in traveling along the roads one ascends from one to half a dozen in traversing a mile, and only now and then a short space of level road between them, though there is nearly always a bridge, or at least a culvert, crossing the creeks that wind their way in and out among the hills.

Usually the banks of the creeks, often ten or more feet high, are bordered with a thick growth of trees and bushes. Such a diversity of situations is favorable to a wide dissimilarity in varieties of the flora covering a small space of territory, and though the number of species may not be greater than is usual in other localities, the divergence, I believe, is more marked. Many of them are common in the East.

In March I often found the white Dog-tooth Violet, or Adder's Tongue, with its spotted leaves, and nodding, bell-shaped, lily-like flowers. By the first of May the spring beauties arrived; they were the "Mayflowers" of that locality. I never found the delicate little Wood Anemone, our "Mayflower" in Wisconsin. There were the Dutchman's Breeches, or White Hearts (a much prettier name for so dainty a blossom), but instead of the creamy tint ascribed to them by Gray, they were tinged with pink. Of violets there were several varieties, purple, blue and yellow (though the latter were more of the Pansy variety, having leafy, jointed stems), and after several years of searching I found a few scattering white ones. Then one spring I discovered a large patch of white ones right where I had often been before without seeing one! I dug up some of them and planted a bed of them in the yard where they flourished for a year or two, but soon they, as well as their sisters of the wood, vanished as suddenly as they had come, and, I believe, I never found any again.

Among other early flowers were Jack-in-the-Pulpit, or Indian Turnip; the Mandrake, or Mayapple; the pale, purple Phlox; Life Everlasting; Peppergrass; and the pretty little pink Oxalis. Then there were the red and yellow Columbine; Buttercups; Cranesbill; blue Lobelia; tall blue Bellflower, and a dark blue perennial Larkspur. Dotted over the grass ground were the bright little blossoms of the yellow Star-grass, of two varieties; and the delicate little Blue-eyed grass, some pale blue, others white.

The orange-colored Puccoon and the orange-red Milkweed lent color to the landscape. There was the tall, pale pink-flowered Milkweed; also the tall blue Spiderwort, or Shellflower, which is a lovely plant; nothing prettier need be desired than a large clump of them when crowned with their beautiful blue, three-petaled flowers of gauze-like texture. Wild Roses were abundant; and in the summer some of the hills would be yellow with the Partridge Pea Senna, a member of the Pulse family, Cassia chamecrista, with leaves resembling the locust, and open, yellow flowers about an inch across and arranged along the under side of the main stem.

The Wild Orange Lily, Lilium Philadelphicum, which Mrs. Wm. Starr Dana, in "How to Know the Wild Flowers," calls the Wood Lily and describes as growing in the "shadowy wood," but which I do not remember of ever seeing there, but always on the hill-top in full sun, among the tall grasses. In shady, moist woods were found rarely the large yellow Ladies' Slipper, and once I found the small white one with dainty little slippers an inch in length. More rarely still grew the pink variety, which I never succeeded in finding.

Another rare and delicate flower was the Indian Pipe, or Corpse Plant, the pure white, parasitic plant found growing in damp rich woods. The whole plant, stem, the bracts which answer for leaves, and flowers are pure white; the only touch of color about it being the yellow stamens. But when bruised, or withering, it shows its fungous likeness by turning black. Of ferns there were several species, including the Maidenhair, Adiantum pedatum; the Sensitive Fern, Onoclea sensibilis; and others, six or seven.

In the creeks and marshy places were the Arrowhead with its Calla-like leaves, and spikes of small white flowers; the Blue Flag; and occasionally the Cat-tail Flag. In summer and autumn the Goldenrod and Asters of several varieties flourished on every side. Also wild Sunflowers and their near relation, the Compass Plant, whose leaves always show the points of compass by standing on the east and west sides of the plant with their edges pointing north and south. Longfellow, in "Evangeline," calls it a "delicate" plant, which shows that he was not familiar with it, as it is a large, rather coarse plant.

Of the Gentians, I found three varieties, the tall, slender, Closed Gentian, both light blue and white; and in late summer and autumn, the deep, dark blue variety about a foot in height, with open, bell-shaped flowers, which I have dried and kept in good color nearly or quite all winter.

In enumerating the wild flowers one must not forget the flowering trees, which furnish some of our earliest spring blossoms. The Wild Plum; the Hawthorn, or Thornapple; the beautiful Wild Crab-apple, with its deliciously scented flowers, some pink, others red. Also the Wild Black Cherry, whose fine, white blossoms are, however, surpassed in size by those of the Choke Cherry, a small tree or rather shrub which is pretty enough for the yard. There was another small, flowering tree, the Sweet Viburnum, or Sheepberry, with blossoms like small snow-balls.

Of vines there was a variety, including the Wild Morning Glory, white with a faint tinge of blush; the Five leaved Ivy, or Virginia Creeper; the Greenbrier, with its bristly green stems and large, shining leaves; the Ground-nut, Wild Bean, Wild Yam, or Tuberous rooted Wistaria, as it is variously called,—the florists sell it under the name of Apios tuberosa: it has a large, egg-shaped tuber sometimes the size of a goose egg, several of them connected by a small root, which gives them the appearance of being strung on a cord. Some people, I believe, eat them.

There are two varieties of Clematis, a purple, and a white which is like a mist of whiteness, as is also the Wild Cucumber when in bloom; this is sometimes called Creeper, also Bladder Cucumber from its dry prickly pod. The Wild Hop is very plentiful and bears large, fine hops. The False Bittersweet with its bright red and orange berries is quite ornamental for winter decoration, as it keeps its bright colors indefinitely.

One of the most curious vines I found was the Dodder, a fine, thread-like leafless vine of an orange color, that formed a perfect tangle about the tall weeds on which it grew. This is a parasitic plant, the seeds germinate in the ground, from which the plants rise until able to attach themselves to herbs or shrubs on which they ever afterward subsist, their own roots and lower stems withering away as they are no longer made use of by the plant.

Besides those described, there were many others, some of which I did not classify, but many of them were more of a weedy nature than the above, though they helped to brighten the fields and pastures. ELMA IONA LOCKE.

Surnames and Complexion.

A curious investigation reported to the British Association traces the origin of complexion by the surnames. It was based on an examination of 14,561 school children of East Aberdeenshire, and a calculation of the pigmentation of the hair and eyes for 59 most frequent surnames. The darkest hair and eyes belong to surnames common in fishing communities, verifying the tradition that the fishing population of East Scotland is of Belgian origin. The pigmentation of Highland surnames corresponds closely with that of their districts of origin. The surnames of Wallace, Pirie, Grant, Park, and Birnie have strong blonde tendencies; those of Cordiner, Cruickshank, Stephen, Strachan, Buchan, Paterson, and Whyte are darkest; and Rennie, Scott, Grant, and Thomson show most red hair. Of course, this statement admits of many exceptions, as any one may readily observe.

Questions and Answers

QUESTIONS NOT ANSWERED.

Answers are solicited, especially for all questions so far without replies. Questions will appear but twice, successively. Those unanswered will then be designated by numbers. The following, need reply —233, 246–267, 230, 293–4, 297, 299, 309–11.

308. City Plants Sleepless. A writer says that city trees and other plants do ill because they cannot sleep, on account of the noise and lights? Is not this pure fudge?
Country.

309. Jerking Cars. Have inventors despaired of remedying the continual jerking motion of cars on even the best railroads; also the rebounding when stopping and starting, especially on the elevated roads? Or are there good inventions to prevent this evil, which the roads are too careless to adopt? L. D.

310. What is Biliousness? And what is the best cure? M. S. S.

311. Catarrh. Is this only of the part affected, to be treated only by local applications, or is it due to the condition of the system, and how treated? M. S. S.

312. Back-Plastering. What is this, in speaking of houses? Wayback.

313. Voice Culture. How can the voice be strengthened and a distinct articulation be gained? R. T.

314. What Should an Audience Room be? I mean as to proportions best adapted to hearing. R. T.

315. Pitch of Voice. Has every one a natural individual note or pitch? R. T.

316. Are there any Rules of Emphasis? False emphasis seems to be a common sin. R. T.

317. The Judas Tree. Is it rare to see this tree in flower in the fall? It began to blossom near New York this autumn.
H. Botan.

318. Why no Bright Autumn Colors? Notably few around New York this fall; and yet we are told that a long season favors bright colors. H. Botan.

319. New Method of Ice Making. I do not find the inventor's name in the Newark Directory. What further information? Belleview Avenue.

321. Sound of Steam Pipes. How can the hammering sound of steam pipes be prevented? And what is the cause?
G. N.

322. Do Fish Sleep? This is affirmed by some and it is denied by other observers. Piscator.

323. Movements of a Crowd. It is always the fact that a crowd, leaving a car or an assembly room, is obliged to move very slow in the rear while the persons in front are supposed to walk without undue delay. Can any one explain the vexatious mystery? W. J.

324. Date of Mammoth' What data for the assertion that the newly discovered Siberian mammoth lived 100,000 years ago? J. J. S.

325. Images of Buddha. Where can I find examples of the alleged Mexican images of Buddha, and what is the evidence that they are verily such? J. J. S.

326. Weather Forecasts. Why is it that so many of the official forecasts fail?
Farmer.

327. Raw Colors. When I use a set of colors in painting the effect is raw and unnatural. Why is it? Eugenia.

328. Colors and Complexion. For a sallow complexion what colors should be worn near the face to correct the defect?
Eugenia.

ANSWERS.

273. Reported Experiment in Lifting. I have tried an experiment similar to the one referred to, many times, and always successfully. If the subject be asked to stand on a book or other support with his heels and toes projecting over the edges, two persons only, one on each side, by placing two fingers of one hand under the heel and two of the other hand under the toe, and breathing as directed by your correspondent, should have no trouble in lifting him nearly to the ceiling. I have known two young men of average build to lift 190 pounds of a man, chest high, in this way with great ease.

As an explanation of this phenomenon, I would propose the following: The subject's breathing seems to be of importance only because it helps him to hold himself absolutely rigid and in this condition he is more easily managed. Of course there cannot be any change in his weight as such. The breathing of the experimenters, however, appears to have a more fundamental influence. In the first place, the rythm of it makes them lift together, and in this way the work to be done is divided equally between them. Now a man can lift almost as much with the first and second fingers as with the whole hand—their use is not to originate but to transmit energy, and during a very short period these two fingers seem capable of transmitting almost all the force that a man can exert, although they become fatigued much more rapidly than would all four fingers working together.

Furthermore, in this case it is not the arms alone, but the back and especially the legs that are concerned in the effort, and it is not at all extraordinary that a man should be able to lift, by a straight leg-pull, his half of even two hundred pounds without great difficulty. Indeed, according to a chart used in the Brown University Gymnasium, and compiled from the measures of 2,300 students, the average lad of twenty ought to be able to pull some 350 pounds with his back, and 430 pounds with his legs.

The only thing that is at all hard to account for, is the remarkable ease with which one seems to be accomplishing this feat. Ordinarily, when one is exerting himself, the muscles of the walls of the chest and abdomen become very tense, and a large part of what we call the "feeling of effort," is simply these peculiar muscle-sensations, which the lower centers of the brain receive and automatically interpret—only the resulting perception or idea emerging into consciousness. Now, in the present case, these muscles are already tense from the holding of a deep breath, and the corresponding subconscious muscle-sensations are already accounted for in a conscious perception of breathing. From which it follows that when the exertion takes place, no new sensations of this kind are sent to the brain, there is practically no change in the subconscious centers, and no feeling of effort emerges.

Of course these are only suggestions, and should be empirically verified before being accepted as a "scientific" explanation—but even now they may be of interest as indicating a path which may lead some other observer to an authoritative conclusion. H. N. Davis.

Brown University, R. I.

300. How do Astronomers Know the Dark Stars? By their influence on the motions of the stars which we can see—and sometimes because they eclipse these more observable neighbors. One of the most remarkable illustrations is Algol or B Persei. This, says Prof. Young, "General Astronomy," pp. 528–, seems to suffer a partial eclipse at short intervals. . . Its period is 2 d. 20 h. 48 m. 55. s. which is subject to almost no variation. . . During most of the time the star remains of the second magnitude. At the time of obscuration it loses about five-sixths of its light, falling to the fourth magnitude in about four and one-half hours, remaining at the minimum for about twenty minutes, and then in three and one-half hours recovering its original condition.

That this is due to an eclipse of some sort has now been practically demonstrated, as by Vogel in 1889, who found that from twelve to eighteen hours before the obscuration, Algol is receding from us at the rate of nearly twenty-seven miles a second, while after the minimum it approaches us at the same rate. This is just what it ought to do if it had a large dark companion, and the two were revolving around their common center of gravity in an orbit nearly edgewise to the earth. Vogel's conclusions are, that the distance of the dark star from Algol is about 3,250,000 miles; that their diameters are respectively about 840,000 and 1,060,000 miles [the earth's is some 7,917 miles]; that their united mass is about two thirds that of the sun [the earth's is $\frac{1}{332000}$ that of the sun]; and their density is about one-fifth that of the sun [ours is twenty times as great].

Furthermore, from certain slow variations in the observed period of the star, combined with certain minute irregularities in its proper motion, Chandler has shown it to be likely that this swiftly moving pair is itself revolving around another distant and invisible star in an orbit about as large as that of Uranus, with a period of about 130 years. Tisseraud, however, suggest a different explanation. H. N. DAVIS.

Brown University, R. I.

305. Binding Pamphlets. There are books on the subject of binding as well as on other trades, to be had of publishing houses that deal in that line. If one is satisfied with flimsy work, like that of English cloth binding, he can bring the backs of the sheets together, evenly pressed, and use nothing but fragile cheese-cloth glued on to hold the sheets in place and to hold them on the covers. The good old way is to stretch two strings upright on a frame,—for octavo size 5 or 6 inches apart; then run strong thread in the fold of each set of sheets through to and around the strings, tying each. The twines may be sunk in a cross groove on the back of the sheets, and are frayed or flattened out where they are glued to the interior of the cover, there hidden by lining paper. MECHANIC.

306. Razor Strop. A man may as well buy a wooden strop with flat, fine, artificial slate on one side and leather on the other. A few passes, keeping the razor perfectly flat, on the slate and then on the leather, at every second or third shaving, will keep a good razor in order. In case a person prefers to make his own strop, he can rub in the finest emery flour on one side of a thick leather strip, mixing it with vaseline, and on the other side jeweler's rouge with non-drying oil. R. B.

307. Typewriter Ink. This is another instance where one better buy, than make for himself. If he prefers a permanent carbon ink, he might use a recipe in the English Mechanic, namely: Take vaseline high boiling point; melt in warm bath or slow fire, and incorporate by constant stirring as much lampblack as it will take up without becoming granular. Remove the mixture from the fire, and while it is cooling mix equal parts of petroleum, benzine, and rectified oil of turpentine, in which dissolve the fatty ink introduced in small portions by constant agitation. R. B.

312. Back Plastering. A phrase used for lath and plaster between, not on, studding, half way between the room plaster and the outside boarding. Air spaces are excellent non-conductors, and by back plastering you get two such spaces, securing warmth in winter. Sheathing paper is better than nothing, but is comparatively inefficient. In cold climates, build for cold. Cheap half-burned brick, set on edge, may be used instead of this method. MECHANIC.

313. Voice Culture. Every power must be exercised to strengthen it, of course. Public speakers need much of this in the beginning of their career. I know a man of very moderately developed physique, a mumbling speaker at first, who often exercised his voice to its utmost extent, going to a forest for this purpose, with the result of gaining a powerful voice after several years' practice. He also read through, aloud, all the great poets, devoting to this a half hour each day, standing with chest expanded and giving all expression possible. For clear articulation, try and try again as long as necessary, sounding each letter, not silent, in every word pronounced. One exercise recommended is speaking in a loud whisper, so distinctly that person placed at a distance can hear every word. H. W P.

314. Audience Room. An old rule is width and height equal and the length twice that measure, for a large hall. How far this has been verified in use I cannot say. One thing seems certain,—that voice is lost in an audience room that is very high; such places are for shows, not for hearing. But, halls have their unaccountable idiosyncrasies,—for example, a not very large lecture-room, with truncated ceiling; also a high gothic church, not improved in acoustic properties by wires where the ceiling should be; in both structures, sound is minced meat of indescribable materials, and if the speaker said "bovine" it could not be distinguished from "porcine" or "canine." H. W. P.

315. Pitch of Voice. Let any one sing as loud as he can and he will find that there is one note he can sound louder than the other notes. That I call his natural pitch. H. W. P.

316. Rules of Emphasis. The inquirer will find these in any standard book of elocution; only beware of books by persons, not recognized elocutionists, who think they are wiser than Murdoch or Russell. False emphasis is the most common sin, even among many who have passed through well-known schools and colleges. They know no better than to try and be very impressive by putting stress on many words that do not demand it, even on the pronouns, auxiliary verbs, prepositions, and other little words. For instance, in reading the Beatitudes, they will inevitably emphasize "they," which needs no stress at all. One might almost say "don't emphasize" at all, or don't try. The most perfect elocutionists are the most natural, speaking without any strained effort. The truth is that, when natural, emphasis is distributed in varying degrees of propriety through the whole sentence. And even pitch and time emphasize without stress,—a high or low note, and a prolonging, or a staccato shortening, of words, also a slur.

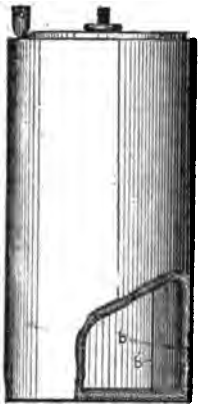
H. W. P.

317. The Judas Tree. Its second blossoming, this last fall, was not exceptional this year. There are reports of various trees in flower and some in fruit, due to an unusually long season. It is a beautiful tree with peach-like blossoms.

H. B. T.

New Dry Battery.

In a new dry battery devised by Henry Splitdorf, of New York, the zinc element is slit longitudinally and is placed in a case comprising inner and outer concentric paper shells, between which is placed a packing consisting of a mixture of paraffin and resin. By this construction the electrolyte has access to the outer as well as the inner surface of the electrodes, while the packing prevents the fluid from reaching the outermost shell. The casing will, therefore, always remain dry and intact, while the life of the battery is greatly increased.—Elec. Review.



NEW DRY BATTERY.

Electrolytic Bleaching.

Experiments have been conducted in the laboratory of Trinity College, Hartford, Conn., in electrolytic bleaching. The fabric to be bleached was saturated with a solution of sodium chloride containing free hydrochloric acid, and placed between two carbon electrodes carrying a weak current at an electromotive force of two volts The bleaching effect at the anode is credited to the nascent oxygen, produced by the secondary chemical reaction between the liberated chlorine and the water. The best results are obtained with a very small current-intensity, and an electromotive force below 1·67 volt.

Electrically Lighted Buoys.

A novel plan is designed to do away with the lighthouses for night navigation between Montreal and Quebec, and to substitute an electric system. The idea is to sink a cable in the center of the navigable channel of the river for power transmitted from a power house at Montreal. Lines of colored lights, supported by cork buoys, will be placed at the water level on each side of the channel, the lights on one side being of a different color from those on the other side.

Searchlight from Lightships.

It is proposed to project a 13-inch stream of light from the sea to the sky, which will be visible forty miles away. The electric lights on the lightship now on Diamond shoal can only be seen thirteen miles. The searchlight apparatus will be arranged between the two mastheads, and the rolling of the ship will produce a distinctive wavering light to be reflected from the sky.

Snow Fortification.

Snow is an effective material for military defense. In late tests a wall 4 feet thick was proof against the very penetrative rifle used by the Norwegian army.

CURRENT NOTES.

Marconi and the Atlantic.

Thursday, Dec. 12, 1901, is to mark an epoch, if the reports of Marconi's work at Newfoundland signify the beginning of wireless telegraphing, of practical value, across the Atlantic. On that day he is said to have received from Cornwall, England, a signal agreed on, the letter S, that is, three dots of the Morse system—not once, but repeatedly. It is not incredible, since his work has been successful over long distances.

A Carbonless Arc-Light.

A new carbonless arc lamp, recently invented, consists of an exhausted glass globe in which, instead of carbons kept at the proper distance by a complicated regulator, are two L-shaped aluminum arms with platinum points, kept at the proper interval by simple clockwork. The new lamp casts no shadow, and is used up very slowly; the aluminum arms need replacing only about once a year.

Biograph in Anthropology.

At a lecture at Field Columbian Museum, Chicago, recently, on the dances and ceremonies of savage peoples, the biograph was used to illustrate some of the subjects spoken of. Dances were illustrated, and also the method of making fire by fire-sticks. This is the first time the biograph has been used on an anthropological expedition in the field.

Microphone Applied to Arc Lamps.

A member of the faculty of the Moscow imperial technical school recently discovered that a microphone, when attached to an electric arc lamp by wire, will transmit sounds through the medium of another electric arc lamp. Repeated experiments were made, in which the two lamps were separated by a thick wall. The inventor read in a low voice a lecture on his discovery, and his words, spoken into the microphone, were audible in the next room.

X-Rays without a Vacuum.

The X rays of M. A. Rodon are produced directly in the air, without a Crookes vacuum, under the simultaneous action of ultra-violet rays and an electric field. When an electric field is set up between the plates of an air condenser and a pencil of ultra-violet rays is directed upon one of the plates, the Röntgen rays are propagated along the direction of the lines of electric force of the field, and have greatest activity if the ultra violet radiation is in this direction.

Blood Powder.

The blood collected in great quantities in abattoirs is by a rapid German process dried by spraying into a hot-air current in an oven shaped chamber. The powder collected in the receiver is claimed to be tasteless, and contains 74·8 per cent. of digestible albumen.

BOOK NOTICES.

Bird Studies with a Camera, with Introductory Chapters on the Outfit and Methods of the Bird Photographer. By Frank M. Chapman, author of Handbook of Birds of Eastern North America, Bird-Life, etc. With over one hundred photographs from nature, by the author. New York: D. Appleton & Co. Pp. 218. The author, a curator in the American Museum of Natural History, is well known as an accomplished ornithologist and a leader in his department. This volume must be a surprise to those who are not aware of the extent and triumphant results of the new art of phothographing wild animals in their haunts. It would seem to be among the impossibilities in many instances, but the reader will find in this book the methods of success. The illustrations presented are many and exquisite.

Familiar Life in Field and Forest. The Animals, Birds, Frogs and Salamanders. By F. Schuyler Matthews. With numerous illustrations by the author, and photographs from nature by W. Lyman Underwood. New York: D. Appleton & Co. Pp. 284. Mr. Matthews has made a loving study of the animals described, and has succeeded by patience and caution in getting into close quarters with them, so as to learn much that is not generally known. Ordinarily, we have but a momentary glimpse of wild life, or none at all. This, and similar volumes, really introduce us to many of our interesting fellow-creatures of whom we knew little and that by hearsay. The cuts are many and excellent.

Familiar Flowers of Field and Garden, described and illustrated by F. Schuyler Matthews, author of Familiar Trees, etc. With photographs from nature by L. W. Brownell, and over two hundred drawings by the author, and a systematical index and floral calendar. New York: D. Appleton & Co. 1901. Pp. 308. The same faithfullness is shown in this volume as in Mr. Matthews other volumes. They are trustworthy and entertaining guides for the student and to all who would learn something of the world about us. The photograph illustrations are good and drawings accurate.

Familiar Fish, Their Habits and Capture, a practical book on fresh-water game fish. By Eugene McCarthy, author of the Leaping Ouananiche, a Tale of Lake St. John, etc. With an Introduction by Dr. David Starr Jordan, President of Leland Stanford University. Illustrated. New York: D. Appleton & Co. The author is a successful angler and gives his experience for the benefit of the unskillful, whom, however, he does not encourage in wanton destruction of life, but rather inculcates the true sportsman's respect for it beyond the immediate culinary need. He is a worthy disciple of Isaac Walton.

Animals of the Past, by Frederic A Lucas, Curator of the Division of Comparative Anatomy, U. S. National Museum. Fully illustrated. New York, McClure, Phillips & Co., 1901. Pp. 258. Among all the popular science volumes issued of late and formerly, it is a wonder that this subject—the extinct strange forms of the past—has not long since enlisted the pen of some scientific writer for the people, in book form. The task could not have fallen into the hands of one more competent than Mr. Lucas; and the artists contributory are equal to the occasion, so far as new drawings were demanded. Of one of them, Mr. Knight, it is said that he is the one modern artist who can picture prehistoric animals with artistic charm of presentation as well as with full scientific accuracy. Full-page plates by him, giving life-like reproductions of monsters, with scenes, include the three-horned Triceratops, the marvellously armed Stegosaurus, the Thespesius, etc. And his coadjutor, Mr. Gleeson, has equally good restorations of Tylosaurus, a great sea lizard, Hesperornis, the great toothed diver, and other unique creatures.

Mr. Lucas has chapters on How Fossils are Formed, The Earliest Known Vertebrates, Birds of Old, The Dinosaurs, The Mammoth, The Mastodon, Why Animals become Extinct, and other cognate subjects. It was high time thus to resurrect the past in a trustworthy volume, instead of leaving the old wonders to piecemeal and distorted presentations in the sensational papers.

Blue-Grass and Rhododendron: Outdoors in Old Kentucky, by John Fox, Jr. New York, Charles Scribner's Sons. 1901. Pp. 294. Full of information and sprightly description and narrative, this book offers the next thing to the reader's personal experience of life in Kentucky. Among the subjects are the mountaineer and his traits, rafting on the Kentucky river, hunting foxes and other game, the primitive arts of the farmers, and cabin and roadside scenes,—all which are charmingly illustrated by photogravures and sketches, in the manner that so signally marks the progress of book art at the present time.

Water and Water Supplies. By John C. Thresh, M.D., D.Sc. Third edition, revised and enlarged. Philadelphia, P. Blakiston, Son & Co. 1901. Pp. 527. Dr. Thresh is well known as having high position as a health authority in London hospitals and other institutions. Everything pertaining to water supply is here treated and illustrated, not overlooking the neglected matter of rural and village supplies. It is a subject of increasing importance in view of the revelations of all sorts of noxious contamination of potable waters. While not a treatise on engineering, it gives sufficient information to enable the inquirer to judge intelligently of plans proposed. $2.

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Photographic Railroad Record.

A photographer has devised a plan by which a train can be made to work the shutter of a camera, the shutter being controlled by an electro-magnet, in whose circuit a contact was included that could be placed on the metals. On the arrival of the train the engine made the contact, the shutter was opened, the camera took the picture, and the shutter closed again immediately the train had passed.

◆

A Color-Changing Paint.

A color-changing paint, especially adapted for making visible hot boxes in machinery, is prepared by a German chemist by carefully rubbing up equal parts of mercuric iodide and cupric iodide with enough distilled water to form a thin paste. At ordinary temperature this mixture is red, but it turns black at about 60° C., becoming red again on cooling.

◆

The Little Texan Deer.

The Little Deer of the Chisos Mountains, Texas, Odocoileus couesi, has also been found in Mexico, Arizona and New Mexico. Owing to the distance of the Chisos Mountains from the railroad and the unfitness of the country for grazing purposes, the deer were still to be found there in considerable numbers. The adult buck would weigh only one hundred pounds, the doe much less. This interesting race should be saved from extinction.

◆

Another Appliance for the Deaf.

A new Russian apparatus for restoring hearing consists of a light rubber shell, furnished with a miniature microphone, which is connected to a small galvanic battery. It is claimed that the microphone causes even the softest speech to react on the auditory nerve of the deaf when the apparatus is placed to the ear.

Peace or War in South Africa. By A. M. S. Methuen. London. American Reprint by Charles D. Pierce, 136 Liberty st., New York. An important octavo book of 93 pages, at the nominal price of only 10 cents. It is a temperate discussion of the subject by an able Englishman, with all the important historical facts, and showing clearly the utter lack of justification of the terrible war, on the part of England, as well as the many mistakes and special injustices that have marked the attempt to crush the two republics. It cannot be denied that the Boer concessions tended to peace, when, Sept. 12th, 1899, Mr. Chamberlain broke off negotiations to formulate his own proposals. He did not want peace. The Boers could obtain no definite reply as to the meaning of his despatch, and meanwhile a large force of British troops were concentrating on the Natal border and an army corps made ready to sail for South Africa. All this was virtual declaration of war,—not Pres. Kruger's demand that the troops be withdrawn. Sir Alfred Milner let out the truth, May 7, 1901, when he said they had set out from the first to make South Africa one country,—an object, which, on their part, it is certain the Boers never conspired to accomplish, as often asserted by their traducers.

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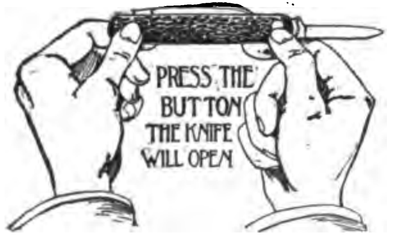

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108 Fulton Street, New York.

Transactions of the American Otological Society, Thirty-fourth Annual Meeting, July, 1901. Vol. VII, Part IV. Pp. 589. Mercury Publishing Co., New Bedford, Mass. The important papers include several on diseases of the ear, together with discussions of malformation, the limits of hearing, etc ; a bibliography for the year, and an obituary notice, and fine portrait of the first president of the society, Dr. Henry D. Noyes, of New York.

Transactions of the Academy of Science of St. Louis. Vol. XI, No. 7.—The Progress made in Botany during the Nineteenth Century, by William Trelease. Pp. 142. A valuable resumé. The author concludes that America leads the world in the attention given to botanical research relating to agriculture and horticulture, due largely to the work of government laboratories and experiment stations.

American Society of Civil Engineers, Proceedings, Vol. XXVII, No. 9. 220 West Fifty-seventh st., New York. Pp. 989—1082. Hydraulic problems, current meter and weir discharge comparisons, modern office buildings, septic tank, effect of curvature on flow of water in pipes, are among the subjects discussed.

Outdoor Life and High Altitude Therapy, by Charles Denison, M.D., read before the Colorado State Medical Society, June, 1901. Reed Publishing Co., Denver, Col. The author believes that deficient ventilation is the main predisposing cause of tuberculosis, and that the bad effect is increased by confinement in the thin air of high altitudes. He gives cases of open air recovery.

Devitalized Toxæmia, a Prime Cause of Tuberculosis, by Charles Denison, M.D., Denver, Colorado. Reprint from the New York Medical Journal. This, as the other paper noticed, by Dr. Denison, closes with a recommendation of laws preventive of the great evil here in view.

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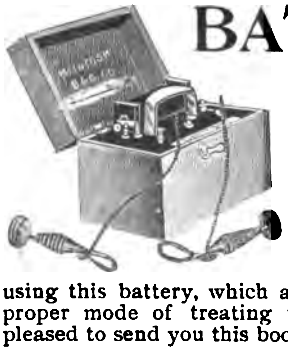

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Relation of Bovine Tuberculosis to the Public Health, by D. E. Salmon, D.V.M., Chief of the Bureau of Animal Industry, U. S. Department of Agriculture, 1901, Bureau of Animal Industry, Bulletin No. 33. Pp. 36. The extent and communicability to man of bovine tuberculosis, frequency of abdominal tuberculosis, etc., are here discussed, with cases cited.

The Forester, Vol. VII, No. 11. American Forestry Association, Washington, D. C., and Lancaster, Pa. A valuable publication in the interests of forest preservation, with numerous and excellent illustrations from photographs.

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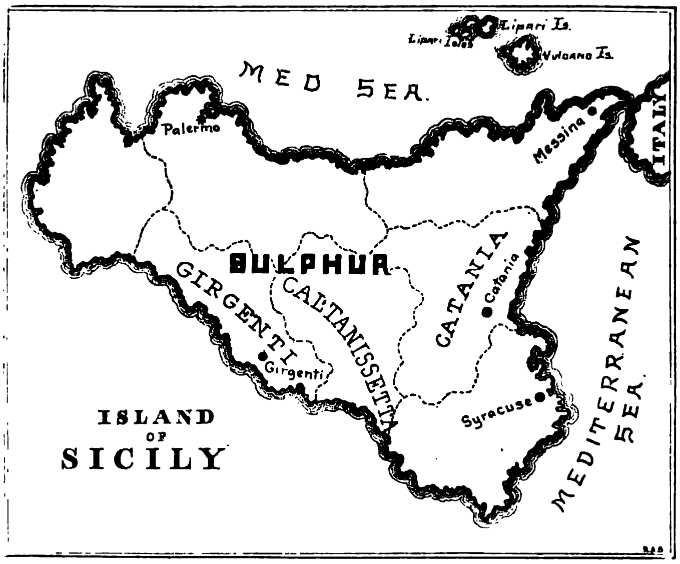

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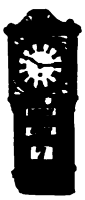

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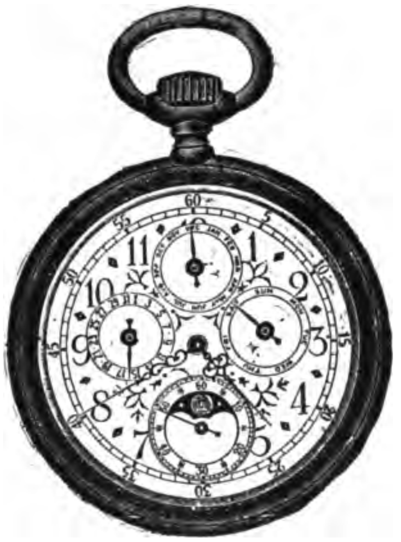

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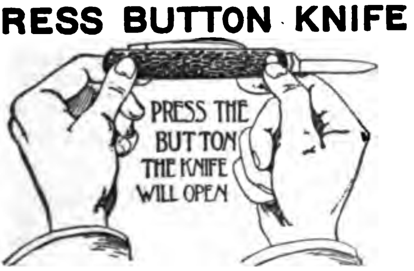

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POPULAR SCIENCE NEWS
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The Unique Sponge Family

By F. P. FIELD

The nature of sponges was at first mistaken; they were classed with vegetables. For a long time their proper place was in doubt; but the labors of naturalists, especially Prof. James H. Clark, decided the question, by showing the animal development of sponges from ova. According to the statements of a foreign naturalist, all animals, except Protozoa, consist when adult of an assemblage of several, often thousands or even many millions of such cells, and these form the other grand division which has received the name of Metazoa. Sponges, named Porifera, are the lowest of all animals which, when adult, consist of more than a single cell.

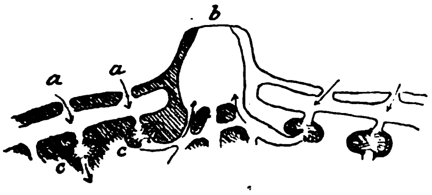
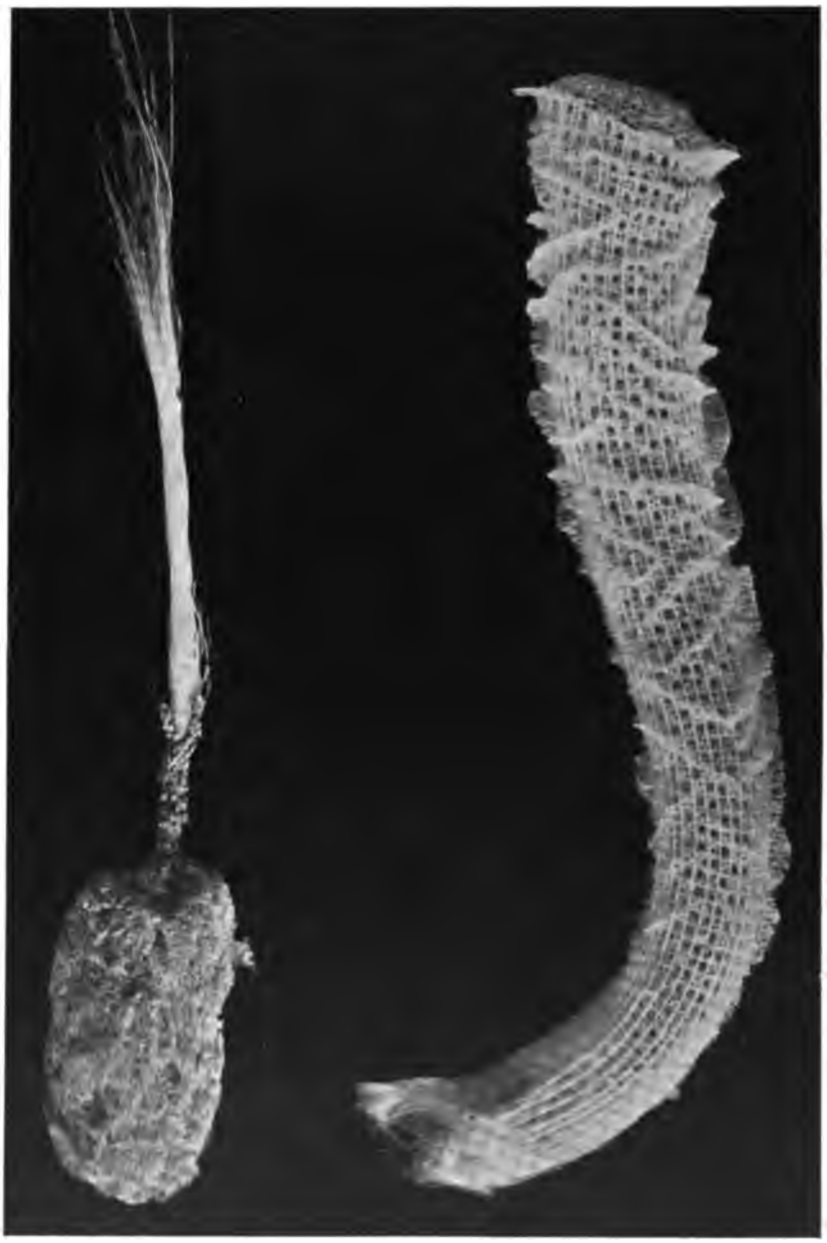


DIAGRAM OF SPONGE.
a, pores. *b*, osculum. *c*, ciliated chambers.

It is a curious fact that if we trace the development of any animal from this starting point of a single cell we shall shortly arrive at a stage which closely resembles and helps to explain the structure of a sponge. And, as all animals very closely resemble each other in their earliest stages and processes of development, it follows that the sponge itself passes through a very similar series of changes. Starting, then, with a simple cell, the first change is a division into two, then each half again divides, the four thus resulting repeat the process, and so on until a hollow ball of cells is formed. Next, by a process which may be imitated by pushing in one side of an india-rubber ball, this hollow and single layer of cells becomes changed into a sac, the walls of which consist of two layers. Between the two layers a third is afterwards formed, and at this stage the structure of a simple sponge is reached.

If we examine a common bath sponge we shall notice that the holes are of two kinds—namely, innumerable small holes and a smaller number of large ones (oscula). The small ones lead by a series of branching canals to tiny chambers or pockets, and from these a second series of canals lead out, join one another, and finally terminate in the large opening on the surface, as in the diagram. If we imagine the outer surface of the sponge covered with an extremely delicate layer of animal matter, formed by a single layer of cells, and all the openings, canals, and chambers lined with a similar layer, and also conceive a gelatinous mass of cells between these two layers closely associated with the soft horny skeleton, we shall have a general idea of what a live sponge is like.



GLASS ROPE SPONGE.
Hyalonema sieboldi (Japan).

VENUS' FLOWER-PASKET.
Euplectella speciosa (Japan).

The small chambers in the interior are of the utmost importance to the animal. The cells lining these chambers are of a peculiar oval or columnar shape, and each of them has the end which faces inwards furnished with a long thread which is lashed to and fro. This curious organism cannot hunt for food like the majority of animals, but has to depend entirely upon the action of these useful thread-bearing cells. By the continued waving of the cilia a current of water is induced, which enters by the small holes, passes through the chambers, and finally makes its exit by the large apertures. Any small particle of food that is thus swept by is caught by one of these active little whips and swallowed by the corresponding cell. The inner end of each of these feeding cells is provided with a hollow wineglass-shaped ring or collar, in the bottom of which the ever-waving lash is fixed. By the action of the latter the food-particles are swept in on one side of the little cup, retained at the bottom until the digestive material is absorbed, and then rejected from the other side. We thus see that a sponge differs from the higher animals in not possessing a mouth, the innumerable pores on the outer surface each taking its share in supplying food to the digestive chambers within.

TUBULAR SPONGE. (BERMUDA.)

SAUCER SPONGE. (EAST INDIES.)
Fan sponge, is like this cut open.

An important subject connected with the life of a sponge is the production of new individuals, or as we may call them, colonies. Certain cells in the middle layer, called "wandering" cells from their power of independent movement, are early developed for the purpose of forming new animals, and after certain processes have been gone through, they are cast off, and acquire a separate existence. Development takes place in the manner we have already described, and it is remarkable that the young animal for a certain length of time is able to swim rapidly through the water. This it is enabled to do by means of innumerable small hairs which clothe the outer surface of the young sponge, and act like oars. After rolling and tumbling about for a little while, the creature settles down, the membranes at the point of contact spread themselves out and form a sucker, and the sponge becomes, like its parent, a sedentary animal.

Although the sponge class contains hundreds of different kinds, only three or four are available for domestic use. This restriction is owing to the fact that the skeletons of the majority of forms, instead of being simply horny, contain a number of hard bodies called spicules, which are composed of either carbonate of lime or silica. These spicules are very minute; but they occur in sufficient numbers to make the skeleton utterly useless for purposes of the toilet. They are of wonderfully varied shape, and make very fascinating objects for the microscope, being shaped like needles, stars, dumb bells, and a variety of other objects.

FINGER SPONGE. (NEW ENGLAND.)

The most valuable member of the class is that known as the Turkey or Levant sponge, and next to this may be reckoned the horse-sponge and the Zimocca sponge. They are all natives of the Mediterranean, occurring at depths of from two to a hundred fathoms. Other kinds more or less useful occur off the Bahamas and coast of Florida, also off the shores of Australia and the South Caroline Islands.

The methods of gathering sponges offer some points of interest, which may be briefly mentioned in conclusion. If they are growing in shallow water they may be raised to the surface by means of harpoons; if at a depth of not more than 40 fathoms, the services of divers are called in; while those growing in very deep sea are sometimes obtained by the use of a dredge. If the water is rough, the fishers of Dalmatia throw a stone dipped in oil in front of the boat, and by thus smoothing the surface the bottom may be clearly seen even at a considerable depth. With a net fastened round his neck to hold the spoil, the diver is let down with no more apparatus than a stone slab as a sinker and a communication-cord. When he has reached the bottom he secures as quickly as possible all the likely specimens within reach, and after a couple of minutes or so he gives the signal to be pulled up.

PINE STUMP OR TREE SPONGE. CLADORHINZA. (Nova Scotia.)

This submarine labor is naturally only carried on during the warmer months of the year, except when a diving-dress is used, as in the case of the Grecian sponge-fishers. In this case the diver can, by means of pumping apparatus, remain below for an hour if the depth be not too great. Much care has to be exercised,

OYSTER DRILLED BY BORING SPONGE. CLIONA. (New England.)

however, in this respect, for a long immersion at a great depth is apt to produce paralysis and other serious troubles. When a sufficient quantity is obtained, the sponges are left for a short time in heaps exposed to the air, and then thrown back into water in specially built tanks, where the soft animal matter rapidly decays. After being thoroughly cleansed by beating, squeezing, and washing, the skeletons are dried, assorted, and conveyed to the market.

RED SPONGE (NEW ENGLAND.) GLASS-CUP SPONGE (MAINE.)

The illustrations of sponges are from photographs by A. Hyatt Verrill.

NOTABLE IMMIGRANT SNAILS.

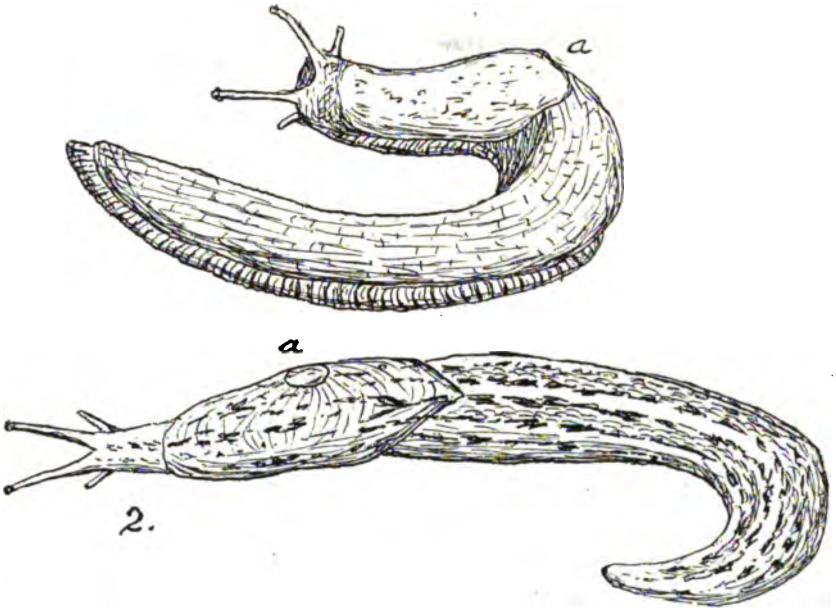
BY H. W. PARKER.

Many persons must have found the slug represented in Fig. 2, here in the eastern United States, and wondered at its great size and its striking pattern of black stripes and blotches on light brown or ashy ground color. It grows to over five inches in length, and as thick as one's finger. Undoubtedly it is the Limax maximus of Gould and Binney; the figure in the younger Binney's manual, 1885, presents large blotches on the mantle (the saddle or cape on the anterior part) and the rest of the body with rather regular dark stripes alternating with lighter spotted ones. The figure herewith is one of the less marked specimens found. There seem to be no two alike, in respect to the size, shape and arrangement of the markings, even when the animal, judged by size, is full-grown.

It is not uncommon on the brick and stone of the outdoor entrance to my cellar, here on Long Island, but I have never found it in the cellar. Like another immigrant in the eastern States, Limax flavus (3 inches long), it doubtless lives on garden vegetation and droppings from the garbage receptacle, going forth at night, and hiding in the cool cellar-way by day, where it finds welcome darkness within the bulkhead doors. Binney accuses this giant limax of cannibalism when confined, and certainly two disappeared of three I had in a glass jar, though the breathing space left by the slightly raised and clasped cover was not wide enough for exit.

The one figured by Binney was found in Newport, R. I., in 1868, and early in the eighties the species was reported in Philadelphia and in Brooklyn, N. Y. It would be interesting to know in what other places it has been noticed and whether it is multiplying. In Europe, whence it immigrated, it is very common.

The specimen of Ariolimax californicus, Fig. 1, has a curious history. It was found at Grinnell, Iowa, in a lot of vegetables sent from California, and is thus a notable instance of accidental distant dispersion, and of involuntary eastward migration. This fellow measured 5¾ inches when crawling full-length, but in a state of rest bunched and wrinkled itself in two inches, and twice its thickness when extended, half of it mantle. The mantle is thick with free margins, and the breathing pore, *a*, shows as an excavation in the edge of the mantle, which is blunt before and behind and contains (as in many slugs) a hidden rudimentary shell or plate,—in this species like the ventral half of a small clam-shell.

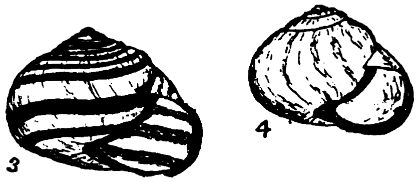


I. ARIOLIMAX CALIFORNICUS. 2. LIMAX MAXIMUS.

This species is found in the lowlands of California and as high up the Sierra Nevada as 3,500 feet. In many points of its anatomy it differs from A. columbianus, a Pacific coast species similar in external appearance, except that it is greenish yellow with purplish-black markings. The A. californicus here figured was of a uniform ochreous yellow, without markings,—those in the drawing being mere wrinkles. A striking feature is the distinct locomotive disk, like that of the genus Arion; it appears in the drawing like a frill the whole length of the slug.

Figs. 3 and 4 will be recognized as an outdoor surprise to many persons in a few eastern United States localities. Its color and bands are unique to us, with our dull-colored natives of the family Helicidæ. A young specimen, Fig. 4, is a beautiful pure yellow with no revolving bands; the transverse lines shown in the drawing are only lines of growth. The bands in Fig. 3 are dark rich brown, approaching black; and the older the individual the less strong is the yellow coloring, almost wholly fading out in age or in dead specimens. It is the Tachea nemoralis, formerly included in Helix, and differs from the very common T. hortensis of Europe (which has been widely naturalized in our northeast) in having the lip black. The bands vary much; in some individuals there is but one. In Fig. 3 the bands show through the translucent shell, inside the aperture, and also in Fig. 4 the interior is lighted by the translucence.

In 1857, Mr. W. G. Binney imported hundreds of living specimens and liberated them in his garden at Burlington, N. J. They multiplied and in twenty years they abounded in that town, but afterwards decreased. Here, in Flushing, I find them not rare on weeds and trees, and am wondering how and when they were introduced,—possibly on imported plants of the extensive nurseries in this vicinity. The means by which species are transported from one country to another are many and various. The subject of new introductions has a practical interest.



VARIETIES OF TACHEA NEMORALIS.

HABITS OF THE CAT-BIRD.

BY M. VICTOR GOODRICH.

Nature has not favored me with knowledge of another such bundle of inconsistencies as is this bird, if, indeed, one exists among all her handiwork. His sober suit of gray speaks of a bird loving to live in peace with every neighbor, and modest to the verge of meekness. Instead he is noisy, excitable, quarrelsome, mischievous, impudent, and audacious. His name is a misnomer, for such a bird should have a name all his own, yet he partakes of the qualities of his namesake.

As a faithful friend of bush, vine, and tree, as an energetic and voracious destroyer of insect foes, he takes due toll—and more—in fruit. I have seen him in the vineyard, after satisfying his hunger, bite open the choicest grapes, bunch after bunch, with an air that left no doubt of mischievous intent. Unless the supply fails he is unlikely, at the least, ever to again visit these damaged clusters; and even then he is such an omnivorous feeder that he may make his meal of something else.

Nearly everything is food to him, even an occasional omelet not coming amiss. I do not know that he ever destroys the young of other birds, but he does the eggs, though not so frequently as the jay, I think. I have stood within thirty feet of a beehive while he perched on the alighting board, and for a space devoured all comers with evident relish. Those same bees would drive a king-bird incontinently from the vicinity of the apiary, as was often witnessed. Some observers, I believe, have credited him with occasional destruction of the nests of the tent caterpillar, and, with this experience in mind, I cannot doubt that he would do it if the notion ever entered his active little brain.

The robin will nest in your pet shade-tree and sing to you from fence-post or house-top. The wren will build in your lilac bush, or under your doorstep, and, swinging jauntily on the nearest twig, fling at you anything from a cheery "good morning" to the slangiest phrase in his repertoire. But your cat-bird, though you may think you know him better, really flaunts in your face only casual glimpses of a personality, as elusive as it is at times insistent. Noisy and officious as he then is, he is a public character only when he wills it; in his heart he loves seclusion. His young are reared in some dense, shady thicket, or perhaps a secluded corner of the orchard, where he gives you very plainly to understand that his privacy in his own, flitting restlessly about you from branch to branch, so silently as to be unseen, even when he is yelling in your ear.

The throat from which that harsh "kuh-yayh" (short a) emanates seems like anything but the lurking place of melody, and even the softer "quit, quit" of expostulation and protest against the disturbing of his domicile gives little hint of its possibilities. But, with all his faults, to those who have knowingly heard his song,

"In all its wild abandon, in all its varied
tune,
That blends with what is purely his the
chorus of the June,"

he will ever remain the sweetest singer that comes to northern Illinois.

He is seldom visible when singing, and, being a mocker, has his song oftenest credited to the bird he imitates and excels, for the listener is almost sure to think, often more correctly than he imagines, that particular singer a most accomplished vocalist.

Going down town one afternoon I paused to talk with a friend. The sky was clearing after a brisk summer shower, and a cat-bird came out in the top of a small tree near by and voiced his feelings in what I must unhesitatingly pronounce the finest bird concert I ever heard. What it all was I cannot say, but he gave us the songs of the robin, oriole, (and I think, thrush), and tame canary (not the ordinary cage bird, but the skilled one who knows how to vary his song with an occasional whistle)—gave them all, as Mr. Kipling says, "with every turn and grace note that a well-trained bird could utter," ending with a burst of exquisite music that so far as I know was pure cat-bird. It is one of my happiest memories.

The Origin of Species.

In an essay printed in the Revue Scientifique, M. F. Marin examines the received forms of the doctrine of the origin of species, criticises them, and brings forward a new presentation of his own. "We believe," he says, "that if, to explain the origin of species, we confine ourselves to the two factors of variation and heredity, considering these factors only from a mechanical, physical and chemical point of view, we can only revolve in vicious circles of reasoning, or produce theories that are merely sterile. We have formed a habit of linking together these concepts of variation and heredity with mechanism in an inseparable unity. We must admit that this unity is not necessary, and that one may allow variation without being a mechanist. Qualitative variation is the contradiction of mechanism; now this is the specific factor of the organization of life. How then ought one to conceive the problem of the origin of species?

"Biological evolution takes place under the influence of two factors. The first is a factor essentially active whose nature is a progress toward an ideal. It is, in itself, spiritual, intelligent, the principle of every action and of all organization, an effort incessantly repeated, everywhere and always. It is not always realized by our consciousness, but consciousness is not essential in intellectual acts. It has often been remarked that what is best in us is what exists without us—that is, the unconscious. The second factor is passive inert, resisting—a material factor that must be organized because, finally, it is through its organization that the active factor attains realization.

"It is the continual interplay of these two terms that constitutes the world. They are always united in fact and only separated by analytical reasoning. In biology we must seek the causes of variation in the influence of the active factor—in the intelligent spontaneity of the organization. The environment has a relation with the organizations that live in it, but it is a negative relation only. Progress is realized in countless ramifications, not along a straight line. The ramified chain of being is continuous and mobile, while in order that we may reason about it we immobilize it as to place, and fix it in a series of types close together. However closely we fix the types, they are discontinuous. What we call the continuity of beings is, in fact, a multitude of special creations. We can thus return, through this dynamical and intelligent interpretation, which takes the place of mechanism, to the consideration of nature."—Sun.

Evolution Interpreted.

Many would reduce the high to the low—the complex to the simple. In Professor Jones' "Browning as a Philosophical Teacher," it is stated that if we wish to know what any particular living thing means, we look in vain to its primary state. We must watch the evolution and revelation of the secret hid in natural life, as it moves through the ascending cycles of the biological kingdom. The idea of evolution, when it is not muddled, is synthetic—not analytic; it explains the simplest in the light of the complex, the beginning in the light of the end, and not vice versa. In a word, it follows the ways of nature, the footsteps of fact, instead of inventing a wilful backward path of its own. And nature explains by gradually expanding. If we hearken to nature, and not to the voice of illusory preconceptions, we shall hear her proclaim at the last stage, "Here is the meaning of the seedling. Now it is clear what it really was; for the power which lay dormant has pushed itself into light, through bud and flower and leaf and fruit." The reality of a growing thing is its highest form of being. The last explains the first, but not the first the last. The first is abstract, incomplete, not yet actual, but mere potency, except in its own actualization.

Instead of degrading man, it (the idea of evolution) lifts nature into a manifestation of spirit. If it were established, if every link of the endless chain were discovered and the continuity of existence were irrefragably proved, science would not overthrow idealism; it would rather vindicate it. It would justify in detail the attempt of poetry and religion and philosophy to interpret all being as the transparent vesture of reason, or love, or whatever other power in the world is regarded as highest.

Plant Life

CELL ACTIVITIES IN BODY BUILDING.

BY PROF. H. L. OSBORN, PH.D.

The primitive beginnings, among the Lower Algæ, form the subject of this writing. Among the wonders of nature we must give a high place to the living cell. It is the unit in the structure of organic beings, whose properties are only the properties of the cell, which have been given peculiar expression through the form that has been taken by cells living in association and forming masses to which the term body is applicable. Bodies, whether they be those of animals or plants, are the product of the reproductive function of cell life. This statement refers not only to the bodies of offspring which spring from egg cells, but also to the body of parent itself, with all its various tissues and organs.

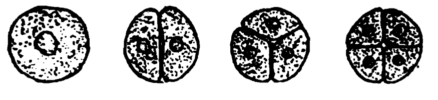


FIG. 1.—Views of different specimens of Protococcus in the process of fission.

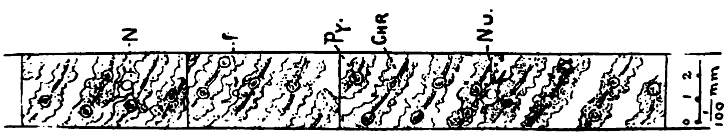


FIG. 2.—Three cells of a filament of Spirogyra, the left-hand two in the later stages of fission. Nu—Nucleus. Py—Pyrenoid. Chr—Chromatophores or spiral chlorophyll band.

We are familar on the one hand with the tiny bodies of the unicellular organisms, in which the single cell has it parts differentiated so as to perform a variety of acts. In vorticella, for example, we see the cilia and the thread in the stem with the function of mobility highly specialized, the central mass of cytoplasm with feeding as its chief concern, and the nucleus chiefly occupied with reproduction, though doubtless regulative of other functions too. And we are familiar also with complex cell aggregates like the higher animals and plants, with large and complex bodies, composed of a great assemblage of cells grouped into communities or tissues, each with a particular form and correlated mode of working. Thin sections of the higher animals or plants demonstrate these cells, and their study forms the subject matter of histology. If we were unfamiliar with the lower multicellular organisms, it would seem to us that a great gulf is placed between the unicellular forms and these higher bodies. But if we look into the lower forms of life, especially plant life, we see various modes of building bodies, which appear to be remnants of the solutions that were so to speak proposed by nature in her essays at the evolution of the higher forms. It is the purpose of this article to attempt to exhibit the structure of some of the lower plants with reference to this matter of progressive body building.

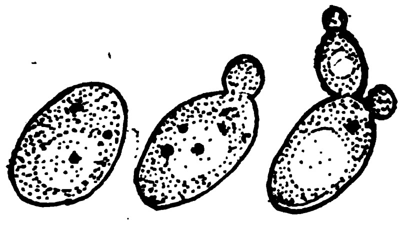


FIG. 3.—Reproduction by "gemmation" or budding, as shown in yeast growing in a nutrient solution.

Everybody knows that among the wonderful powerful powers of the cell is its power to divide in two, each half inheriting the power of growth and subsequent division. As a result of this property, the cell is capable of producing great numbers of its kind. The series expressing the results of cell reproduction would be a geometrical one, viz: 2, 4, 8, 16, 32, 64, 128, 256, and so on, and the number of cells that are produced in ten generations is more than one thousand. But the mere power of reproduction alone would not give a cell the power essential for the production of a body as in a higher multicellular organism.

In the case of Protococcus, we have the power of reproduction. Anyone possessing a microscope can easily see the stages of cell reproduction in Protococcus. The plant grows as a green finely powdered deposit on the trunks of some trees, and on planks, fence-boards and such places, where it is somewhat moist and out of the direct rays of the sun. Looked at with the microscope (high-power) it is found to be made up of a great number of minute spherical green masses, the cells, each one of which is a complete plant. Looking among the individuals some are seen (as in figure 1) which appear to be divided by a line passing through the centre; these are cells which have recently divided (called "fission"). Others have more than one such line, three can be seen in some cases, like radii of a circle, they indicate that one of the cells of the division into two has divided again and the other has not; in still other cases two diameters cut through the cell at right angles to each other; these are the first division plane cutting the original cell into two cells and a subsequent planes dividing each of the cells into two, thus forming four cells.

In looking through a lot of Protococcus, clusters of such cells are found of varying numbers, but never more than eight or ten cells or thereabouts, and more often less. This is due to the fact that the division between the cells is complete, "discontinuous" it is technically called, and in consequence there is no vital continuity between the cells even though they remain for a time in contact mechanically. Consequently Protococcus, though it has one of the functions necessary to the production of a multicellular body, through this lack of continuity in connection with fission, is unable to produce a cell aggregation and remains a unicellular being.

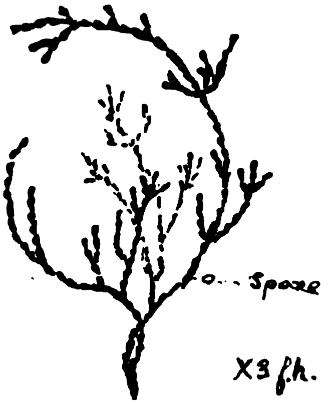


FIG. 4.—View of branching alga, showing plant body built up by combination of fission and gemmation, about three times natural size.

The endowment of continuous fission which is wanting in Protococcus, is present in Spirogyra, which has the form of a thread of indefinite length made up of a linear series of elongate cells (see figure 2). Each cell has its own parts, the nucleus in the centre, the protoplasm forming a lining immediately beneath the cell wall (which it secreted), and in the protoplasm the chromatophores or characteristic bands of chlorophyll with their regularly arranged pyrenoids, the whole constituting the machinery of the cell and repeated in each cell of the filament. We can infer from the form of the filament the mode of cell action which has given rise to it. It must have arisen by repeated cell divisions taking place across the long axis of the cell, and we can find evidence of this by looking through actively growing material (in the early morning after a cold

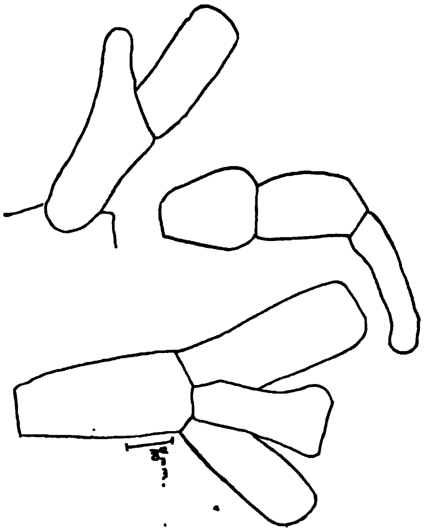


FIG. 5.—Some of the cells of plant shown in fig. 4, showing the process and results of gemmation combined with fission.

night), where we shall find some cells of half the ordinary length, and in them the nuclei of two adjoining cells in close proximity. Figure 2 is drawn from such a filament.

Spirogyra is a case of continuous fission, that is, of division in which the cells that are produced remain in vital connection and together make up a body. The body in this case, however, since the fission is always in one plane, has only increased in length. If the planes of division were as in Protococcus, there would result an increase both in length and breadth. This result is attained in an organism which will be described in another article.

If we look among the unicellular organisms we find a mode of cell growth which appears to differ from that of Protococcus, though at bottom it is a phase of the same process. In yeast, for example (see figure 3), we find a process called budding or gemmation. In gemmation, instead of having a plane of division which cuts the cell in two, a small pimple begins to arise on the surface of the reproducing cell. This pimple, composed of a small portion of the protoplasm of the parent cell, rapidly enlarges and eventually cuts off from the parent by ingrowth of its wall closing the passage between them. It is interesting to find among the algæ, types of branching algæ in which both of these modes of growth are employed. Figure 4 is a drawing from an alga found in the Mississippi river; its counterpart can be found in almost any pool of water. It gives us an interesting example of the employment of both modes of cell reproduction in building up a body which is a little more elaborate than that of Spirogyra. Here we have the linear filaments, but starting from cells are lateral filaments, themselves linear and branching, produced at the beginning (see figure 5) by a process of budding, which budding takes place at distal ends of the cells of the filament.

None of the organisms thus far noted attain much solidity of form; they are consequently restricted to the simplest modes of life. We shall see, however, that the modes of reproduction which they possess are capable, when applied only a little differently, of producing bodies of a very much higher sort than these. By continuous fission, with growth and differentiation taking place among its products, every higher organism is produced. Some of the steps by which this result comes about will be described in another article.

Biol. Lab., Hamline Univ., Minn.

Water Gusher in Desert.

While boring for oil at Engle, N. M., in the heart of the famous "Journey of Death Desert," an artesian well of water was struck which will be more valuable to the region than an oil well could have been. During the Mexican war a detachment of soldiers had to cross this arid region, and out of 165 all but 14 perished for want of water.

BEAUTY OF MARKET VEGETABLES.

BY EMERSON BLAKELY.

Amusement has been offered recently by a real or pretended recommendation of vegetables for millinery adornment, attributed to a vegetarian society. Doubtless, the prosaic associations of these with cookery will bar them from such use. But it is none the less true that beauty of form and color abounds in the products of the kitchen garden; and the subject has been wholly neglected, perhaps because, as in other things, it is so continually presented to the eye that it is overlooked by writers. It has not been wholly slighted by the painters; some of the most elaborate groups in "still-life" pictures have been made up of vegetables; and kitchen gardens, too, have been the subject of paintings, even a field of cabbages, especially by Teutonic artists.

It is in the street that the beauty of vegetables is especially forced on attention. Of course the vegetables and fruits bring their colors with them from the country; but it is all along the barren street that the beauty is presented most vividly to us. How many of the passers-by have eyes to see it and feast upon it daily? In autumn it is a glory of color in front of every grocery; and the Italian, at least, who often presides over it, must enjoy a polychromatic delight, for his wife chooses blazing hues in personal adornment.

And that suggests a danger that the conflagration of colors in women's gear, particularly bonnets, that flares out like a sunset, may blind us to nature's wonderful coloring of the commonest things. Yes, even vegetables for kitchen pot, despite Ruskin's dictum that the refinements of art are desecrated when expended on things of mere industrial utility, such as, we may suppose, the pot and pan, the shovel and tongs. He instances the use of the happiest Greek mouldings for shops and elsewhere. Perhaps he is right in some applications. The most exquisite cabinet work may be degraded by association with certain uses. But even Mother Nature embroiders her stones with moss and her stagnant pools with delicate aquatic growths.

But the vegetables, of all artistic tints and forms! The potato seems to be the only exception; it is a pig, alike in form and color and dirt. But, if it were well cleaned, its buff or red and its argus-eyes might count for something, though it could never come up to Charles Lamb's climax about the delicately delicious roast pig, when he says "it is a flower!"

Take the potato's relative, the tomato. When not crimson or yellow, it is pure and intense carnelian; and perhaps its warm tints gave it the old name "love apple." The red cabbage is royal purple; it is used by chemists to get a fine vegetable color. The egg-plant is purple even to blackness, profoundly rich in hue. The blood-beet is so deep a purplish-red that it may even remind one of Keats' words, "deep-dyed as with the blood of kings." The carrot is pure salmon-red, and adds its bits of glow to our soup. And then there is the bright rose-red of the radish, the globular variety of which is sometimes cut into roses to grace a dinner table. The red peppers are appropriately of fiery color.

The yellows are no less rich. Squashes delight in this, as well as in all fanciful forms, showing all golden effects from pale lemon-yellow to deep burning orange. Along with these are the ruddy pumpkin and the rich buff of the ripe muskmelon. As to the green products, there are all hues and shades, and, in some, these are marvellously variegated, as in the blotched stripes of the citron melon and the well-named snake watermelon; also in the curiously netted stripes of the large green squash. The whites have their varieties, such as the opaque white of turnips, sometimes half colored with red; the flesh-like purity of the parsnip; and the pearly lustre of green corn and white onion.

The color is of course enhanced by form, in which for variety the squashes lead the garden host, with round, lobed, pyriform or with swan like shapes. But what a variety of forms peculiar to each of the others mentioned! And what fulness of form, as in the rotund compact cabbage, the oblate lobed tomato, and the melon swelling out between its longitudinal constrictions. In other vegetables we have the charmingly crimped and crinkled leaves, and some dissected into fringes and frills, as in parsley and the exquisite mats of "chicory-salad."

Mingled with the vegetables, in all the little Agricultural Fairs in front of the groceries, are the various patrician fruits, proverbial for their wonders of color and form that have ever been the poets' and artists' delight. But we sing the vegetables, the plebeians.

The beauty of fruits and flowers has been referred (disproved by recent experiments with flowers and insects) to the æstheticism of animals; and where this failed, to proximate causes, such as growth and the molecular constitution of tissues. But it remains true that the outcome is artistic. It remains true that here, in co-operation with man, there is a great divine *as if;* and if all nature is as by design, we may as well drop the two little particles of speech. Utility does not reign alone in the market-garden; beauty revels there in root and fruit, and smiles forth in the green-grocer's display.

Indeed, the growing foliage only might be arranged in a pretty display for landscape gardening,—say striped-leafed corn for centre, the red-stemmed and broad-leafed rhubarb surrounding this, then the purple cabbage, next the finely fringed parsnip, followed by the red-topped beet, and fronted with a border of bright yellow-green lettuce-heads.

Uses of Weeds.

Growing plants of whatsoever kind, even weeds, draw off into themselves the carbonic acid gas, and often other injurious gases, and give out oxygen in return. So a vacant lot covered with healthy growing weeds is much better for the public health, and certainly is more pleasing to the eye than the bare ground.

Everyone knows that dandelion is an excellent pot-herb when taken by itself and cultivated. It is not so generally known that this is true of chicory, milkweed, and pigweed, although the government is now calling attention to their value as food. Prickly lettuce, while not thoroughly understood, is known to be liked by sheep and is therefore thought to have some quality which will eventually make it useful.

Weed investigation has also resulted in a great addition to the known foods for cattle, and the discovery of a number of plants that will fertilize the soil. During this century and within recent years a score or more of valuable leguminous plants have been discovered in what were considered weeds, and hardly a year passes that new ones are not added to the list. They are plants which make food for cattle and which, when planted in poor soil, improve it by taking from the atmosphere and the deep subsoil things which the surface soil needs. The manner in which they are known to improve poor soil forms a remarkable scientific discovery. Their roots extend into the stiffer and more compact subsoil, where no ordinary plant can reach, and after loosening and opening it up so that air and water can have action upon it, suck up from below great quantities of potash salts and phosphoric acid. When these weeds are plowed under or die, these salts and acids are left near the surface where they can be utilized by the cereals and root crops which live upon them. For instance, wheat and potatoes flourish well where these weeds have gone before and done the work of getting the necessary food for them from the subsoil and the air.

Much land is of no value until these weeds come in and make it so. This is particularly true of sandy soils and reclaimed marsh lands, which are deficient in potash, a thing necessary in all farming land. On these the deeper rooted legumes, such as gorse, broom, alfalfa, lupines, clover, and the perennial beans are of great value. Their roots not only reach down very deep and bring up potash from the subsoil in the manner described, but their leaves take great quantities of nitrogen from the soil. Now, when a soil is rich in potash and nitrogen it is good soil, and as these plants die and leave their gathered potash and nitrogen on the surface, the sandy and marshy soils become good land. All the farmer has to do is plow these rotting weeds under and he has land on which he can raise cereals, root crop, and tobacco—that hardest, most wearing plant upon soil. The government has induced farmers to try the Florida beggar-weed. One experimenter reported that by planting it in his field and plowing under the annual crops for two successive years, the soil had been completely changed in texture and color. Another farmer discovered that a crop of beggar-weed, turned under, will, when decomposed, retain near the surface in ready reach of the roots of succeeding crops not only all the nitrogen that it took during the season, but also whatever fertilizers were subsequently applied. A third reported that all his field produced more luxurious crops after having been given over one season to a rank growth of this weed.—Ainslie's.

Poisonous Fungi.

M. Pietro Pellegrini, an Italian, has lately published the results of his researches upon mushrooms of the poisonous variety, of which the following résumé may be given. The poison of mushrooms dissolves easily in water, and the aqueous extract keeps its toxic properties for a long time, these having been strongly marked at the end of eleven months. The poisonous action is not diminished by the drying of the mushrooms by heat. Mammals and birds show a great sensibility to the poison, even in feeble doses, but on the contrary it is without effect upon cold-blooded animals. The action is shown very clearly when it is injected under the skin; animals, when subjected to frequent injections of this kind, acquire a certain immunity, and the serum of these animals may be used as a remedy in cases of poisoning.

New Substitute for Rubber.

In the Rocky Mountain "greasewood plant" an American is said to have discovered a substitute for rubber. The young shoot of the plant has a milky sap and the old wood a resinous gum; the former is bruised between rollers so that the bark is loosened, and the older wood is crushed. The entire mass is then inclosed in a vessel, mechanically agitated, and exposed to the action of carbon bisulphide, carbon disulphide, naphtha, or other solvent of india-rubber. After exposure for some hours to the action of the solvent, heat being applied if necessary, the liquid is strained off. The liquid solvent and contained gum are then placed in a closed vessel, and the volatile solvent driven off by heat. The gummy mass that will not volatilize in the still or receiver is then washed in water, either warm or hot, and is then subjected to repeated rollings. The gum resulting is of a brown color, highly flexible and elastic, combustible, and possesses the characteristics of india-rubber, except that it has rather a balsamic odor, differing from the odor of commercial rubber. The gum can be vulcanized by the addition of sulphur.

Archaeology

THE NEW PALEOLITHIC PAINTINGS.

BY THE MARQUIS DE NADAILLAC.

Your valuable paper mentions in a recent number a most curious discovery made by MM. Capitan and Breuil in the south of France. (Acad. des Sciences, 16 et 23 Sept., 1901. Rev. de l'Ecole d'Anth. 1901.) Perhaps some details may interest your readers. These gentlemen have found in caverns newly discovered, dating from the last paleolithic period, characteristic designs either engraved or painted. Findings of this kind are always very rare; in France, I can only mention Pair non Pair (Gironde), la Mouthe (Dordogne), discovered by M. Riviere, Chabot on the river Ardeche, perhaps a few others. Out of France, I only know Altamira, in Spain, and I am not sure the figures in this cavern are authentic, and if authentic, they certainly do not belong to the paleolithic times.

The cavern of Combarelles, near Tayac (Dordogne), consists in a long trench, measuring 230 metres in length, 1 m, 50 in breadth, and from 0.30 to 3 m. in height. The first figures easily identified begin on both walls at 119 m. from the entrance of the cavern and continue to its end. These figures vary considerably in size, while some measure one metre and more in height, others are no longer than 0.10. Often they crowd and overlap one another; some, specially at the end of the cavern, are shown of a bluish paint and covered by a thick layer of stalactites.

Most of these drawings are well drawn, and many are remarkable for the correctness of their design. The animals figured, either *in extenso* or in parts, are most interesting for the archæologist. The horse is the most numerous; then comes an equidé very like the hemione; several bovidés, the aurochs being the most remarkable; the saiga, a curious antelope; the reindeer, and above all the mammoth, which till yet has never been discovered in France during the latest paleolithic times. Fourteen mammoths have been identified; their characteristics are easily traced; their high foreheads, teeth, bodies covered with hair, are completely distinct from all other animals pictured, and must have been known to the artist and copied out of life.

One figure may be that of man, but it is very doubtful. A horse seems to carry on his back a covering. The drawing is wonderful, and the same may be said of the Saiga with his straight horns, or of the Bouquetin with his horns bent backwards. The conclusion of these facts is clear. Man was in those days a contemporary in the south of France of the mammoth and of the reindeer.

At about two kilometres from Combarelles is another cavern, Font de Gaume, which opens in a cretaceous cliff and like Combarelles is a long trench, 123 metres in length, with three separate branches measuring respectively 15, 21, and 48 metres. The breadth varies between 2 and 3 metres, and the height exceeds 7 or even 8 metres.

The first animal figurations begin at 65 metres from the opening; they are reached by a narrow passage between two walls of stalactites. Their character is different from all we have seen at Combarelles. The figures are represented by slight lines filled with black paint, and often the body and the legs of the animal are entirely covered with the same black paint. A number of these animals are of a large size. We can mention a reindeer, measuring 1^{m}. 50, and also a small équidé who does not exceed 0, 10 They make us remember the oldest Etruscan pottery; the greatest number are painted in red. The heads of the aurochs were first painted in black and then in red, obtaning a brownish color. On others the hind parts were brown and the heads black. Some are covered by stalactites measuring 2 inches in thickness.

Their number is 77,—49 aurochs, 4 reindeer, 1 stag, 2 équidés, 3 mammoths, 11 yet to be determined. It is the first time, that such a number of figures have been found. These figures belong most probably to the times which in France carry the name of Paleolithic period. Perhaps they are not so old as those described before; but in both cases we are justly astonished to find such artistic performances in times so distant from ours and in which we did not suppose a like civilization.

ANTIQUE STEEL PENS.

BY E. A. KILIAN.

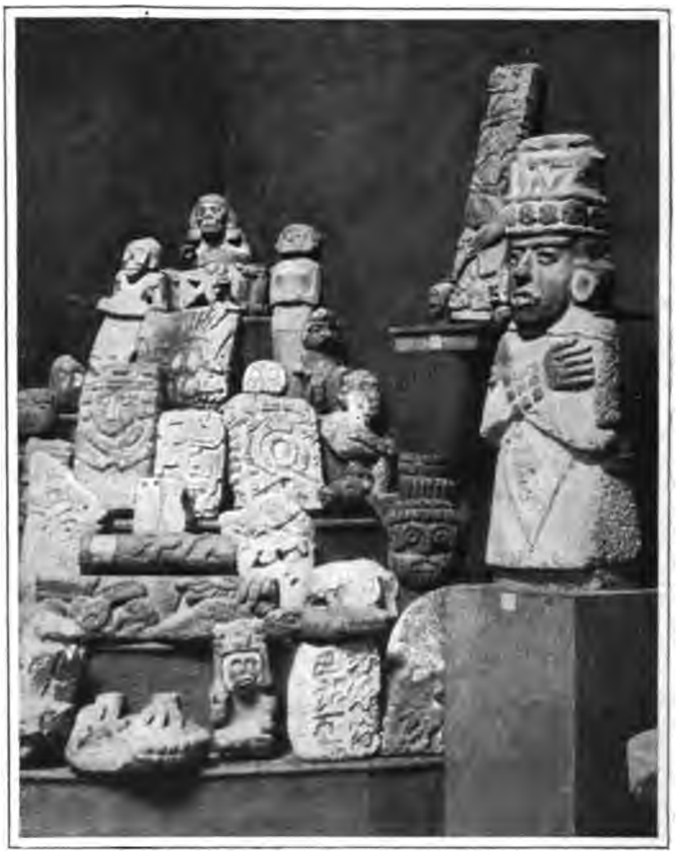
The small plate of metal used by the Nurnberg writing master, Neuhoefer, a contemporary of the renowned painter Albert Duerer, has been repeatedly referred to as the antecedent of the steel pen, also trials with metal pens from various countries long before the present steel pen came into use, have been mentioned, but never was it proven that the Romans already used metal pens, until such a pen was found at Cologne, Germany, together with other antiquities of doubtless Roman origin, and deposited in the city museum. It consists of a hollow bronze tube of not quite the diameter of a lead pencil and about the same length, one end terminating in a pointed split end, having the appearance of our steel pens; pen and holder are of one piece. This recently found pen is not the only one which has been disinterred at Cologne; often such pens have been discovered there.

Complexion and Iron.

M. Floresco finds that there is a relation between the amount of iron in the liver of animals and the color of skin and hair, the dark having twice the amount of that of white animals.

Buddhist Idols in America.

Ancient remains of Buddhism in America are looked upon with doubt by one of our noted archæologists, now exploring Central America. But the following statements by Mr. John Fryer, in Harper's Monthly, are worthy of consideration, as condensed in Public Opinion, and will answer a query on another page of this issue.



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BUDDHIST IDOLS (?) IN MEXICO.

From early times the Chinese classics, as well as the historical, geographical, and poetical works, allude to a country or continent at a great distance to the east of China under the name of Fusang or Fusu. Its approximate distance is given as twenty thousand li, or above six thousand five hundred miles. Its breadth is stated to be ten thousand li, or about three thousand two hundred and fifty miles. A wide sea is said to lie beyond it, which would seem like a reference to the Atlantic ocean. The narrative of only one visit to the land of Fusang is on record in Chinese history, namely that of Hui Shen, a native of Cophène, or Cabul, which was the great center of Buddhist missionary exertions in early times. The narrative states that there was a Buddhist priest named Hui Shen, originally a native of Cabul, who in the year 499 A. D., during the reign of the Emperor Yung Yuan, came from the country of Fusang to King-Chow, the capital of the dynasty of Tsi. Among other things, Hui Shen said that the people of Fusang were formerly in ignorance of the doctrines of Buddha, but during the reign of the Chinese emperor La Wing, A.D. 458, there were five bikshus, or Buddhist monks, from Cabul, who traveled there and promulgated the knowledge of the doctrines, books, and images of Buddhism. Their labors were successful, so that they ordained monks from among the natives; and thus the customs and manners of the people were soon reformed.

The manners and customs of the people, their forms of government, their marriage and funeral ceremonies, their food and clothing, the method of constructing their houses, the absence of soldiers and military weapons, cities, and fortresses, are all particularly noted, and agree with what is found in no countries bordering on the Pacific except on the continent of America in general, and in Mexico in particular.

The religious customs and beliefs of the nations of Mexico, Yucatan, and Central America, their architecture, their calendar, their arts, and many other things which were found by the Spaniards when they conquered America, exhibit the most surprising coincidences with the details of Asiatic beliefs and Asiatic civilization. So much is this the case that independent observers who have known nothing of the story of Hui Shen have been convinced that there must have been some kind of communication between America and Asia since the beginning of the Christian era. Searching for traces of Buddhist origin among the old names of persons, places, and things in America brings to light some curious facts. The name Buddha is not in general use in Asia, but instead is used his patronymic, Gautama, or the name of his race, Sakhya. Hence we may expect to find these names constantly recurring in America. In the places Guatemala, Huatamo, etc., in the high-priest Guatemotzin, etc., we find echoes of the first of these names. In Oaxaca, Zacatecas, Sacatepac, Zacatlan, Sacapulas, etc., we find more than a hint of the second. The Buddhist priests in Tibet and North China are called "lamas," and the Mexican priest is known as the "tlama." When we come to look for visible traces of Buddhism among the antiquities of Mexico, we are soon amply rewarded. Images, such as in the illustration, and sculptured tablets, ornaments, temples, pyramids, etc , abound that can not well be ascribed to any other source with the show of reason.

Archæology Vindicates History.

One would think that the prosaic matter-of-fact Anabasis of Xenophon the last thing to be attacked by destructive critics. But one of our ambitious young college professors has lately attempted it. The editor of The N. Y. Sun, who is not particularly conservative, says, "We are glad to say that the assault on Xenophon's credibility fell flat upon the archæologists. The day of German sceptical criticism is past. The most brilliant demonstrations of Teutonic logic and scholarship have been upset by the brutal retort of pick and shovel. The poetic myths of Homer have been turned into something like reality by Schliemann's digging up Ilium and Mycenæ. Niebuhr's brilliant demolition of early Roman history, after being accepted by scholars for nearly half a century, has been discredited by the later discoveries in the Roman forum.

More and more scholars are coming to the conclusion that Livy and Herodotus and the rest knew what they were talking about and were not credulous fools or liars. The story the Egyptian priests told the Father of History about the four lakes from which the Nile rose has been shown to be pretty nearly true, and Ruwenzori may be after all the Mountains of the Moon. So Livy's black stone from which Romulus was snatched to heaven has been found. While proving nothing about the truth of the legends, it shows that Livy simply repeated what Rome believed.

Archæologists in the last ten or fifteen years have demonstrated the truth of many a story, heretofore held to be mythical. In Egypt they have brought to light not only the first dynasties but civilizations that antedate these by thousands of years. In Crete it seems likely that traces of King Minos and of the Minotaur story have been found, existing in very early times. Wherever they have dug trusting to the old historians and geographers, they have found something. The day of sceptical criticism, we should imagine, has gone by so far as archæology is concerned. The danger is rather of too great credulity for a good many years to come, in view of the wonderful finds that have been made. It is not the archæologists who will accept destructive criticism.

Whatever mistakes Xenophon made, he knew what he spoke of better than his critics, German or American. The Anabasis has all the earmarks of a personal narrative and a truthful one."

Oldest Latin Inscriptions.

Harvard has recently received from Italy a cast of an ancient inscription found in the Roman Forum under the so called black stone, where Romulus is supposed to have been buried. This is the oldest Latin inscription that has ever been discovered, and is thought to date back as far as the seventh century B. C. The original inscription is on a stone pillar, broken half way up. This is thought to have been broken when the Gauls sacked Rome in the fifth century B. C. The inscription is thought to contain certain directions for offering sacrifice.

First Maps of America Found.

Musty with the cobwebs of 400 years, there have just been found in the castle of Wolfegg, Wurtemberg, the first maps that ever contained the name and geographical outlines of America. The maps were discovered by Rev. Joseph Fischer, a priest, who is professor of geography in Feldkirch, the capital of the Austrian province of Vorarlberg. They bear respectively the dates of 1507 and 1516. They are in a state of remarkable preservation. The earliest is believed to have been drawn under the personal supervision of Columbus German geographers consider this find very important. Ror years the maps were regarded as hopelessly lost. Nordenskjold, in his last work, referred to their existence as a legend.

Some Flint-Chippers Not Prehistoric.

Flints were used for muskets, within the memory of some now living, and it illustrated the work of the prehistoric tribes, if not by the same means. Now it appears that the industry has been revived in Norfolk villages, England, to supply the British troops in South Africa with flints for lighting pipes, in the absence of matches.

The Fire-Walkers' Equal.

Mr. O. T. Mason reports, on the authority of a chief of the Cœur d'Alenes, that years ago a medicine-man of his tribe, while singing and dancing, accompanied by all the Indians, went to a vessel containing cold water and sang, and, while all were watching him in awe, he slowly took red-hot stones in both hands and dropped them into the basket of cold water. The water was heated and not a blister or burn could be seen on his hands.

For the old and extensive rite of fire-walking, see POPULAR SCIENCE, 1900.

Mechanical Devices in Egypt.

The inclined plane, says the Carpenter and Builder, is, of all mechanical powers, the one rightly supposed to be used by ancient Egyptian engineering, classic writers having mentioned it, and it probably was used for building the Pyramids.

Nile mud furnishes so convenient a substance for constructing inclined planes of sun-dried bricks that an engineer of the present day would probably build a pylon at Thebes in the same way instead of using scaffolding and cranes, providing that his human labor was unlimited in quantity. It must also be remembered that timber was always very expensive in Egypt. The use of the wedge is but another application of the inclined plane, and was undoubtedly as well known to the ancient Egyptians as to ourselves. The use of the screw is more difficult to trace than any other of the mechanical powers.

We find among the tomb paintings excellent examples of the use of brace and bit and whip drill for boring holes, but it does not follow that the bit was the shape of a screw, for a spoon drill might have been used.

Regarding the Egyptian knowledge of hydraulics and hydrostatics, we can only infer that it was extensive enough to meet their requirements Mechanically speaking, the Greeks discovered the Egyptians just as the Jesuits discovered the Chinese 300 years ago. In both cases there was the same rudimentary knowledge only of all the sciences and arts.

Cave-Man's Body Found.

Not long ago the perfectly preserved body of a man was discovered in a sealed up cave in the French Pyrenees, where stone was being quaried. Beside him were some implements of stone and a drinking cup made of bark. There were also the remains of a fire, and some bones of animals, which fell into dust soon after being exposed to the air. The body was wrapped in what is probably the skin of a cave-bear. The man must have been large and athletic.

The Dog's Ancestor.

Such is the title of an item about a "prehistoric dog," the only skeleton of it in America, and this dug up in Wyoming and set up in the Yale museum, 6 ft. long, plus tail 3⅛ ft. The dog genus Canis includes wolves, jackals, etc., and fossil remains of the family are not rare. The later dog is probably of composite origin.

A Steam Dragon.

French ingenuity has outrun the Yankee, if it be true that a novel stage property is to make its appearance at the Paris Opera in Siegfried. It is a dragon propelled by steam, and much more lifelike in its action than any stage dragon hitherto used. It will jump and leap all over the stage, and will give Siegfried a very bad time—especially if anything goes wrong with the works.

Minerals

[Edited by A. C. Bates].

Apatite was named by Werner from a Greek word meaning to deceive, because the older mineralogists often referred it to many other species. Perhaps the name given no other mineral excites more comment by one first hearing it than does this one of apatite, because of its sound-relation to a word of sometimes deceptive desire—appetite.

Apatite is an orthophosphate of calcium with either fluorine or chlorine, or both, and crystallizes in the hexagonal system.

Apatite occurs commonly in metamorphic crystalline rocks, especially in granular limestone and in metaliferous veins. It is widely distributed; common in minute crystals in volcanic rocks, in crystals of varying size in calcite, and is deposited in granular form in extensive beds. Crystals are sometimes of great size. One crystal found in Buckingham, Quebec, weighed 550 pounds and measured 72½ inches in circumference The range of colors is wide, green predominating. The crystals loose or in matrix are very pleasing as mineralogical specimens.

Apatite is used chiefly for fertilizing purposes, and was mined in quantity at several places in Ontario prior to 1895, the yield in 1889 exceeding 30.500 tons. The decline of the Canadian mines was due to the discovery near Charleston, S. C., and at other points in the Atlantic Coast States, particularly in Florida, of immense beds of coprolites, a nodular phosphate of organic origin. A singular interchange relative to the mineral industry between Canada and the Southern States is to be noted. As is here shown the phosphate industry of Canada was seriously interferred with by that of the Southern States. Recently there was discovered in Canada near the apatite mines, large deposits of corundum, a mineral in much demand and heretofore mined in the U. S. most extensively in North and South Carolina. The corundum is mined in Canada much more cheaply than in the Carolinas, and it remains to be seen to what extent the Northern corundum mines will cripple those of the South.

Developing.—To see a thing develop,—a photograph, a picture under an artist's hand, a bud into a bloom, a seed sprout up into a plant, is one of the most interesting entertainments one can enjoy. But to see a crystal develop as nature does it, is denied us. We may experiment with chemicals to make a demonstration, but the product is so purely artificial as to be unsatisfactory when compared with the real thing. The beautiful modellings of the agents of the mineral kingdom are all worked out in caverns beyond our ken. Sometime we may find a way to break into caverns and see crystals grow as we now sometimes see stalactites grow.

Speaking of growth, as related to a collection of minerals or anything else, it is healthiest when made from a small beginning. The sight of a single crystal should excite as much wonder and interest and a desire to know something about it, to possess one and then to collect many, as would the sight of a collection. It is again a matter of development. One must digest to appreciate a good thing. Desire and reverence make the ideal lover of anything worth the having.

APATITE CRYSTAL IN CALCITE, RENFREW CO., ONTARIO.

In Arizona, mines have absolute first right to water, whether the same is being used for agricultural purposes or not. A water right owned by a farmer can be condemned by a mining company if the latter shows that it is absolutely necessary for mining purposes. Of course, the mine company usually is compelled to pay pretty steep damages on so acquiring water rights.

Marble.—The Vermont quarries have furnished nearly all the best quality of marble used in the east. The recent discoveries in Washington of several immense ledges of fine quality marble, so placed as to make quarrying easy, will, it is said, make that state the banner producer of this building stone.

A New Cave. -Early in December last, a new and wonderful natural cave, believed to be one of the largest known, was discovered in the canyon of the Jefferson, about 50 miles east of Butte, Montana. A partial exploration by a small party was made to a depth of nearly 1,000 feet and of about 10 miles of passages. Articles of stone and copper and some bones were found.

Mining Terms are curious enough to warrant an exposition of their meaning. It may be said that there are four general methods for the development of a mining vein or lode.

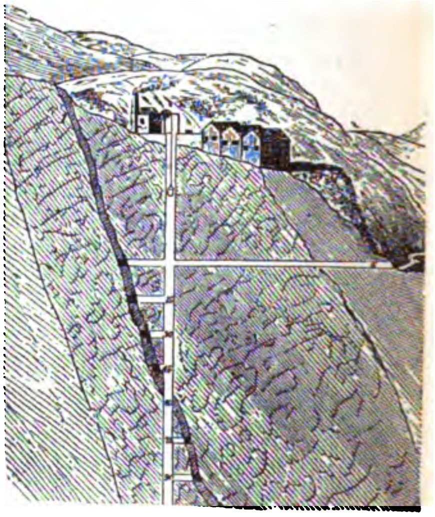
First—The sinking of a shaft direct on the vein itself.

Second—Where the vein outcrops down the sides of a steep slope or mountain incline, the running of a tunnel on the vein, which kind of tunnel is known as adit.

Third—The running of a tunnel at right angles with the vein, with the view to reaching it at a given measured depth below the outcrop, known as a cross cut; and

Fourth—The sinking of a perpendicular shaft, with occasional cross-cuts, developthe vein on its dip.

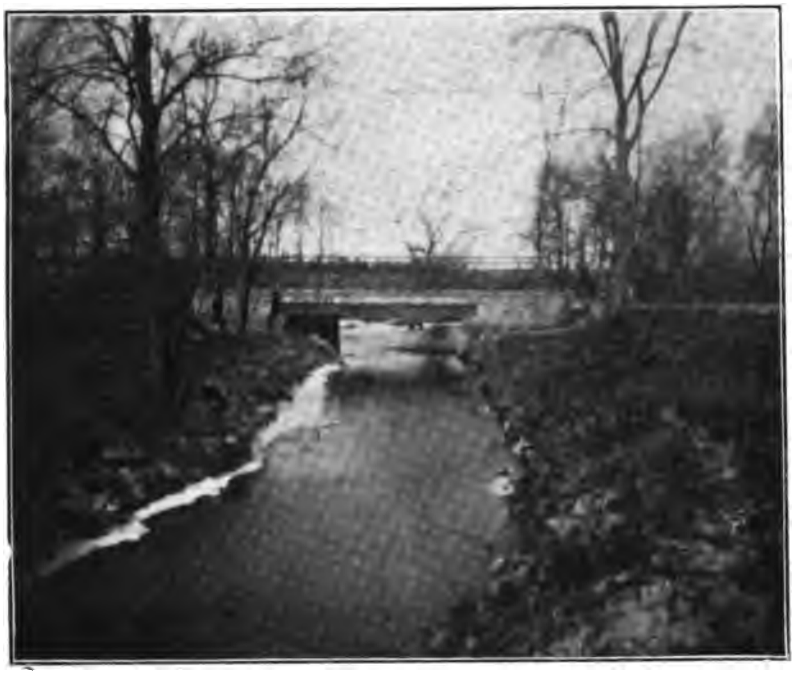
By all odds the most satisfactory and economical method of developing a vein, where it can be adopted, is that known as the adit tunnel. This is a tunnel, which, while it develops the vein itself and acts as a drain for the exit of water, at the same time is driven on the mineral. The sinking of the shaft on the vein is second in importance, and, in fact, until the character of the pay streak has been clearly determined, it might be ranked first in order.



MINING, SHOWING SHAFT, HORIZONTAL TUNNEL AND CROSS CUTS ON THE VEIN.

To "stay with your mineral" is a precept too often neglected by unskilled or uninformed miners. Many of these have no sooner uncovered an attractive looking mineral lead than they at once begin to calculate how much easier it would be to remove the ore through a cross cut tunnel, the mouth of which is located at a long distance from the vein itself; hence, the country mountain sides in certain districts are honeycombed with the vain results of this over-confidence in the continuance and continuity of mineral veins. After the pay streak has been clearly located and defined by means of a shaft, generally an inclined one, upon the vein, it will do to sink a perpendicular shaft, crossing the vein at a given depth, cross cuts from which may be used in developing same.

The last and most questionable method of developing mining property in its initial stages is that of a cross-cut tunnel, and yet when the continuity of the vein has been sufficiently established to give assurance that it continues to great depths, the cross-cut tunnel often becomes a very valuable factor in the economical removal of mineral, and especially for drainage.



Pinhole photo by R. Conklin. BRIGHT LIGHT, 8 SECONDS EXPOSURE.

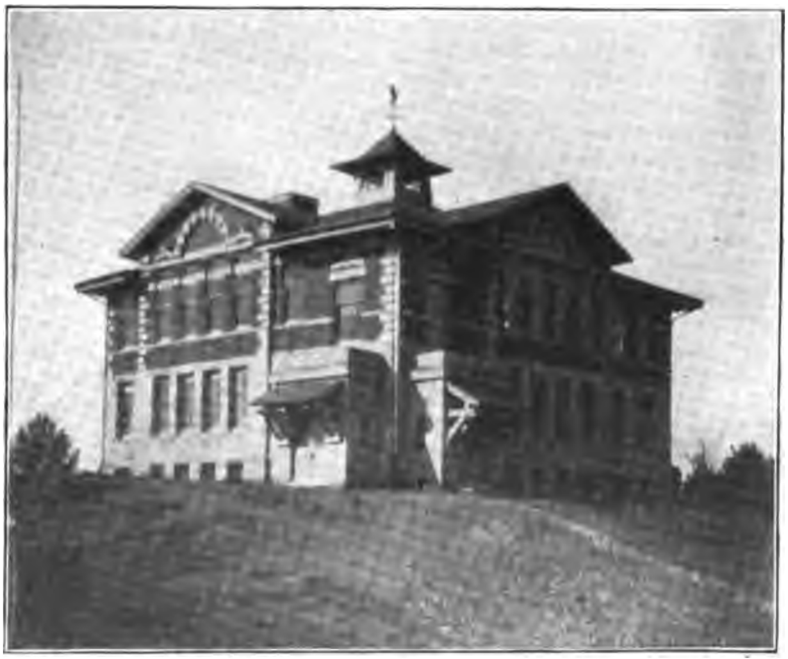
Adit—A horizontal tunnel to the vein.
Apex—The top or higher point of a vein.
Breast—The face of a tunnel or drift.
Contact—A junction of two kinds of rock, such as limestone and porphyry.
Cross-Cut—A level driven across the course of a vein.
Dip—The slope or pitch of a vein.
Face—The end of a drift or tunnel.
Fault—The displacement (by nature) of a stratum or vein.
Feeder—A small vein entering into a larger vein.
Fissure Vein—A crack in the earth's crust containing minerals.
Foot Wall—Rock beneath a vein.
Hanging Wall—The layer of rock or wall overhanging a lode.
Lode—A metallic vein, or any regular course, whether metallic or not.
Pocket—A rich spot in a vein or deposit.
Stope—Steplike; to excavate in the form of steps. To fill with rubbish the space from which the ore has been worked out.
Stulls—A framework to support the rubbish when stoping.
Stump—A hole in the bottom of shaft or tunnel for collecting the water.
Vein—An aggregation of mineral matter in rock fissure.
Winze—A shaft sunk from one mine level to another.

Photography

PINHOLE PHOTOGRAPHY.

BY D. P D.

The lens is often called the eye of the camera, as it is considered the most important part of the outfit. Indeed, it is something which the average amateur is constantly improving upon by selling the old and buying a new and better. There are many amateurs who are to-day using a lens costing as much as two hundred dollars or even higher.



Pinhole photo by R. Conklin. BRIGHT SUN, 8 SECONDS EXPOSURE.

In many of the failures of the beginner the lens is blamed, when in reality the incorrect exposure or faulty development is the cause. The purpose of the lens is to collect or gather in the reflected light rays of the object, and project them, sharp and distinct, at its focus. It is therefore generally conceded that the better the quality of the lens, the better or sharper will be the negative or print. Conversely, the poorer quality lens used would result in a like inferior photograph. Continuing this reasoning still further, it would seem that no lens at all would produce no picture.

Even with the wide knowledge now extant on the subject of photography, it will be a surprise to many to know that excellent photographs may be taken absolutely with no lens at all.

The photos here reproduced were taken with an ordinary 4 x 5 bellows camera with the lens and shutter removed, and the opening closed by pasting over it a double thickness of black or opaque paper. Opposite the centre of the opening a hole was made by carefully piercing with an ordinary household pin. The distance from the pin hole to the plate was seven inches, and the exposure eight seconds with a Cramer Crown plate, bright sunlight. In the reproduction many of the light and shadow effects are lost, but the beautiful soft effects presented by this method are entirely lacking when a lens is used. As it was stated to the writer, "Pinhole photography takes a picture the same as it is when you look at it, the shadows are not made to look twice as dark as they really are, which is usually the case in photography."

The proper way to arrange the camera for this work is to remove the lenses, but retain the shutter, and place back of it a disc of ruby-colored celluloid with a pinhole in the center. Focussing is not necessary; but it is well to examine the ground glass before making the exposure, to determine the size of the desired object. When the focusing cloth is first placed over the head, it is difficult to see the image as the light is very dim; but when the eyes become accustomed to the light, it is readily discernible.

The further the pinhole from the plate (or the longer the focus) the larger will be the object on the plate, and vice versa. With a short focus a very wide field can be photographed, but the exposure required is much shorter than with the long focus.

It is not necessary to have a camera arranged as described above; one who does not possess a camera may use any light-tight box with a pinhole on one side, and a plate fastened on the other. The distance between the two may be arranged either for a "wide angle," or "rectilinear" effect; seven inches is very satisfactory for ordinary purposes. It is not necessary to have even a plate-holder, as the plate can be placed in the box while in the dark room, and as there is no focusing to be done, it is a simple matter to make the exposure.

Pinhole photography affords new pleasures to many, and with ordinary care and fast plates gives beautiful results.

Photographic Notes.

The old social custom of "showing the photograph album" has now become quite the fashion again, and it is undoubtedly an improvement on the original. The old, stiff, staring daguerrotypes have been replaced by the more pleasing results of some member of the household, for nearly every household has at least one "camera-fiend." So when the friends gather together, out comes the album, and the visitor gazes upon the array with a critical eye, when the usual discussion of "exposure," "developer," "diaphragm," etc., is sure to follow. Many a bright evening is spent in this way, evenings that would otherwise be dull and uninteresting.

It is stated on good authority that to preserve negatives for any great length of time, one fixing bath is not sufficient, and there is nothing gained by having it more than ordinary strength. Removing the plate to a fresh bath of same strength after all traces of chloride of silver have disappeared, and following by careful washing, renders the negatives in condition to keep indefinitely.

"Fuzziness" is the name given to the new-school prints, sometimes called artistic, or high art photography. There are still many who prefer the distinct, sharp-cut, immaculate print of the perfect focus, to the smeary, "fuzzy" creations of the "artistic" photographer. Photography at its best is mechanical, and "fuzziness" is but an attempt to imitate drawing in rayon or pastel, or something else which s an art in reality.

Hall's Journal of Health

Founded by Dr. Wm. M. Hall, 1854.

THE EAR AND ITS CARE.

BY O. B. SALISBURY.

Little notice is commonly taken of the outward form of our organ of hearing, and even artists do not give it much consideration as a rule; yet the formation and shape of the ear will amply repay those who give it close attention. Our modern portrait painters seldom go into minute detail of it. They seem content with a general outline and a rough touch here and there, showing the principal points. The sculptors are more particular, and, among the antique, one seldom sees a good piece of statuary without noticing that great care has been taken to correctly model the ear, which shows it was regarded as worthy of study.

A well-formed ear is an object of beauty, and like all other things in the realm of nature, is exquisitely adapted and designed for the function it performs—that of collecting and concentrating the undulations of sound. Add to this the color of the ear and a new element of beauty is contributed. Ears vary greatly in form and size and sometimes assume distinct peculiarities in shape. Women have much better shaped ears than men. They are usually much smaller, and lie closer to the head. Some people possess a singular muscular power over the ear, and can move the upper part at will; but it is rarely met with.

The structure of the ear is worth studying from an anatomical point of view. Beginning with the outer fold or ridge, called the helix, which forms the outline, it is composed of thin cartilage and integument. The next prominent ridge is the antihelix, which in some people is very largely developed, but in a well formed ear projects very little beyond the level of the helix. Between the helix and antihelix is a narrow curved groove, the fossa of the helix; and in the fork of the antihelix is a somewhat triangular depression, the fossa of the antihelix. The little knob that projects from the foot of the antihelix is called the antitragus. The deep well in the centre of the ear is the concha; and last of all the fleshy part below is called the lobe or lobule.

The concha, so termed from its shell-like form, plays the most important part in reflecting the vibrations into the inner ear; in fact, all these projections and depressions are of importance to our hearing, and play their own parts in conveying the undulations of sound to the drum of the ear. A recent experimenter adds the direction of the sound as an important function.

Owing to the immense variety of size and form in ears, it is somewhat difficult to definitely classify them; but they may be roughly divided into two divisions which are easily identified—Div. I, with curved pendulous lobe; Div. II, with straight lobe.

Besides the peculiarities of shape, the ear may be large or small, protruding or flat, and straight or sloping. Some ears have pointed tops, while others have not. Small and thin ears usually denote delidelicacy and refinement; and abnormally large, thick ears are associated with a sensual and coarse nature.

Ears of the first division are by far the most common, while not more than one person in fifty possess the straight-lobed ear of the second division. This peculiarly shaped ear is often hereditary, and can be traced back in some families for generations. People with musical tastes generally have large and prominent ears; while the thin, angular ear is said to denote bad temper and cruelty. The ears of many great philosophers and statesmen have been noticed to be large and sloping. As age increases, the ear becomes more angular and marked. A beautiful ear should be slightly sloping, the whole being a series of graceful curves, the antihelix without undue prominence, and the lobe decided, without being heavy.

From our youth upwards, the ear does not receive much consideration. It is pinched to signify pleasure, it is sometimes boxed to denote anger, and even pierced or bored for purpose of vain ornamentation. The very ancient but barbarous custom of piercing the ears, which now we are glad to observe is considered unfashionable, has spoiled and disfigured the shape of thousands of ears through the perforation of the lobe for the purpose of wearing earrings.

The study of the form of the human ear is exceedingly interesting, and one that is now receiving the attention of many scientists. In Italy, Germany and France, investigations have been carried on for some years, and a great deal has been written on the subject, although as long as three centuries ago ancient psychologists endeavored to prove that the ear is an index of character. As it is now almost conclusively proved, from recorded investigations, that the ears of many persons afflicted with lunacy, epilepsy, idiocy, and a large number of criminals, exhibit marked peculiarities in their formation, it is quite possible the ears of normal persons may be found on close observance to reveal some of their chief characteristics. From these facts it will be seen that the form of the ear will repay the study of the careful student of human nature.

The ear as an organ is extremely sensitive, the slightest changes affecting the circulation, causing the flushing and redness often noticed, especially in persons of nervous temperament.

As to the care of the ear, the ears of some children have a tendency to protrude, and should receive attention when they are young. During sleep they often get doubled, and then the head lies on them—a habit which, if not checked, will cause the ears to grow misshapen and protruding. To prevent this, a close cap of some stiff material, made to cover the ears, should be worn at night till the child grows older. Instead of the cap, the ear may be bound to the head by a band of linen, a ribbon, or by the hair.

Where the opposite defect exists—that is to say, where the ear is set too close against the head, a wedge-shaped fold of linen, worn for a time at night between the ear and the head, will generally suffice to separate them somewhat. When the fashion of wearing the hair will admit of it, this result may be hastened by letting a lock of hair take the place of the wedge of linen during the daytime. Where the ear is deformed beyond all hope of remedy, a judicious arrangement of the hair will do much to disguise the deformity. The present fashion of drawing the hair down over the ears is advantageous in such cases.

Owing to the peculiar conformation of the ears, which causes them to retain in their grooves and depressions the insensible perspiration and the particles of dust which collect there, the most scrupulous cleanliness should be observed with respect to them. They should be carefully cleansed every morning with a superfatted soap and warm water; while benzoin lotion and rose water, or other mildly aromatic water, may be used with special propriety here. In drying the ears, much harm is sometimes done by the common habit of making a screw of a corner of the towel, and driving this into the ear. They can be dried thoroughly and safely by the gentle use of a soft towel.

The wax which is secreted by the glands of the ear, and which is nature's barrier, as has been said, against intruding insect, dust, impure exhalations, and loud sounds, should, nevertheless, be removed occasionally, as it sometimes hardens into a solid mass, producing temporary deafness, and causing, if allowed to remain, serious changes in the shape of the passage, and even symptoms resembling diseases of the brain. When the wax has been allowed to accumulate in this way, it is especially necessary to use the greatest care in removing. A little oil of sweet almond dropped into the ear helps to soften the wax. The ear should then be syringed with tepid water, the greatest care being employed in the operation, as the ear-drum might otherwise be injured, and the wax removed with an ear spoon. After this, the drum-head may be forced slightly outward by taking a long inspiration, closing the mouth and nostrils, and forcing the air against the middle ear.

When there is a discharge from the ear, syringe with a weak solution of boracic acid in warm water, and put salicylic wool lightly into the ear after. In the case of earache, which is frequently caused by cold and damp weather, equal parts of oil of sweet almonds and laudanum will give relief. Never push small pieces of wool into the ear; they may get into the ear passage out of reach and do mischief. The ear is a feature of beauty, and, for this and its use, is worthy our attention and care.

Cure for Hiccough.

A young girl suffered for four days without cessation from singultus, about thirty spasms to the minute, the attack being due, apparently, to some gastric disorder. When she put out her tongue for a few seconds it was found the hiccough ceased. She was then ordered to stick out this member at regular intervals for a few minutes, at the termination of which only a few slight spasms followed. She was then ordered to repeat, when the singultus ceased altogether, and did not again return. It therefore would seem to be proper to try continuous or rhythmic traction of the tongue in these cases.—Revue de Ther. pd.

Treatment of Sore Throat.

One of the best remedies for sore throat is a compress worn over the throat at night. A piece of muslin or light cloth about half the size of an ordinary handkerchief should be folded so as to cover a space of about three or four inches, wrung lightly out of cold water, and placed around the neck. This should be covered by a piece of rubber cloth, oil silk, or oiled muslin. A long, narrow strip of dry cloth should now be wrapped around the neck in such a way as to hold the compress firmly in place. If this compress is so put on as to retain its place, prevent evaporation, and exclude the air, it is an admirable remedy. It should be put on when retiring at night and taken off in the morning on arising, the neck being then washed off in cold water and rubbed until the skin glows.—Diet. & Hyg. Gaz. pd

Camphorated Glycerine for Blisters.

After the application of blisters, fatty dressings or boric acid vaseline are often prescribed for dressing the wound. Senlecq points out that all such oily substances are unsuitable for the purpose, since they give rise, with the least trace of canthardin, to a fresh blister. Camphorated glycerine is a much more suitable dressing, since not only does glycerine, as pointed out by Piccard, arrest the blistering effect of cantharidin, but the camphor, at once antiseptic and sedative, also counteracts the harmful effect of that poison on the bladder.—Union Pharm. pd.

Cancer Cure.

A case of recovery from malignant cancer, said to have been brought about by the application of violet leaves, is attracting attention in London. This old-woman's remedy was tried after all approved methods of treatment had failed. The fact of a cure is authenticated, but whether it was the result of the violet leaves cannot be known without further trial.

Various Topics

PROBLEM OF AERIAL NAVIGATION.

BY W. S.

In an article published recently in the North American Review, Rear Admiral S. W. Melville, engineer in chief of the United States Navy, gives a very clear exposition of the difficulties appertaining to the problem of aerial navigation.

Admiral Melville evidently feels very strongly the responsibility devolving upon the members of the engineering profession in their position as leaders and shapers of modern progress and industry; and in his article has shown conclusively the opinion of one engineer, at least, upon this much mooted question.

The engineer of to-day must not only be equipped by his technical knowledge to solve purely physical problems, but to be successful he must also be able to grapple with and master the commercial end of an undertaking. The question that confronts the engineer is not only can a thing be made, but can it be made to pay.

It is from these two standpoints that Admiral Melville treats the problem of aerial navigation. There is nothing in all probability more hedged about with difficulties that the construction of "the dirigible balloon." The inability of a balloon to maintain its shape has always to be dealt with. The internal pressure upon an open bottomed hydrogen-filled balloon is only one and a half pounds per square foot; this will give way and collapse under the impact of a moderate wind of only a few miles per hour, and it is hardly feasible to support the surface of such a balloon with a metal framework, owing to the great size to be supported and the weight of material.

If the balloon be closed at the bottom and inflated with hydrogen gas under pressure, it is better able to resist the impact of the wind, but the external air pressure decreases rapidly as the balloon ascends, for the rarity increases with the altitude and danger of its bursting from the interal pressure is imminent. The tensile strength of the material from which it is made must be limited necessarily by its weight. A balloon has to be made of enormous size in order to carry sufficient propelling power to maintain its position against the wind, and here, too, the weight of material is a consideration; the larger the balloon the stronger and heavier must it be made. Nature has to depend upon the strength of bone (phosphate of lime) and muscles in constructing her flying machines, and has probably reached the limit of possibility as far as size is concerned with the material with which she has to work.

Man's chief advantage over nature lies in his ability to use stronger material; however the span is so great from the weight of the largest bird to that of the smallest machine capable of supporting itself and a human being, that it is extremely doubtful whether steel can be depended upon to accomplish the desired result.

If steel does prove strong enough to make this the minimum size of a human flying machine, what is to be used in the construction of a larger machine of practical commercial value? Man will still have to contend with the same difficulties that confront nature. An insect can hardly fall far enough to sustain an injury from the fall; a man may not slip with impunity upon the ice.

The strength of material must always increase vastly more in proportion than does the size, and in aerial navigation the strength of material must always be limited by its weight—as the strength of material increases as the square of its dimension while its weight increases as the cube of the same dimension approximately.

Therefore the construction of a practical flying machine seems extremely doubtful, and in the light of our present knowledge one of any real commercial usefulness is almost beyond the pale of possibility.

THE GOLD HUNTERS OF COLORADO.

BY H. A. CRAFTS.

The Colorado prospector probably typifies the human attribute of hope as completely as any other member of the race. He seems never to be discouraged, and no doubt dies with a vision of rich gold mines before his fading sight. He seems to be an exception to the rule that "hope deferred maketh the heart sick." The reason for this is probably in the fact that there is enough life and excitement about his occupation to keep his hope stimulated. And I am not sure but what he is to be envied after all, for he seems to live continually in the midst of bright dreams.

Then there is the delightful uncertainty about his life that there is in throwing dice. The next stroke of the pick, the next thrust of the shovel, the next washing from his pan may reveal the nucleus of a fortune. Then each hour, each day, each month, each season in their endless succession may have in store the golden promise of wealth.

And now and then comes the full realization of the most fervid dreams. After long years of alternate hope and disappointment, of changing from place to place, of labor, hardship and privations, a single turn of the wheel may bring uppermost the lucky number, the talisman of untold wealth. Herein no doubt lies the fascination of the thing, the quality that appeals so strongly to the gambling propensity of the average man.

So gold hunting in Colorado is not confined to the "tenderfoot" who has been thrown by the upheaval of popular excitement and set adrift among the hills and gulches, but has become one of the established industries of the state. The ranks are recruited from both young and old, the young taking it up as a career, the old as a makeshift after many other inventions have failed. The field has no limits; when the surface has been explored there still remains the hidden recesses of the rocks to be penetrated.

But when will the surface ever be thoroughly explored? The state of Colorado has an area of more than 103,000 square miles, more than two-thirds of which is mountainous and having mineral possibilities. And how cunningly are the precious metals hidden! For more than twenty-five years the gold-bearing earth of Cripple Creek was tramped over before its mineral wealth was discovered. So the Colorado prospector is in no imminent danger of losing his occupation.

The Colorado prospector, if he has not sufficient financial backing of his own, has no great difficulty in enlisting some from outside. And from my observations I should say that the ordinary prospector is not usually possessed in his own right, and in the first instance, with a plethora of worldly wealth, but if he has a smooth tongue, a plausible tale and possibly a few samples of ore in his pocket, this difficulty may be readily overcome.

First there is a near relative or personal friend that may be appealed to for aid; then there are business men, professional men, etc., in towns, who out of friendship or an itching to dabble in the chances of striking it rich by vicarious effort, will put up for the prospector. "Grub staking" is a very common mode of helping out a poor prospector. This may be done either by an individual or a syndicate, and though it may be years before there are any returns, or there may never be any, the hope is so strong that a fortune will be struck some time, that funds are constantly forthcoming to prosecute the enterprise.

Again, there are friends in the east and even in the old country who have a little laid by and can be induced by an urgent appeal or a glowing account of possible riches to contribute their support to a feasible looking mining scheme. In some of the larger Colorado towns there are moneyed men who keep their prospectors in the field almost constantly.

In enterprises of this kind they have to depend entirely upon the good judgment and honesty of the prospector, as to how the work shall be done, and the money contributed for any given enterprises shall be expended. A dishonest prospector might take his outfit for which his backer had paid, go off into the mountains, and put in an entire season loafing, hunting or fishing, and nobody be the wiser for it. Or, he might strike a promising mineral location, stake off a few claims in the name of the co partnership, and then put in the balance of the time working upon claims filed on by himself individually. But as a general thing instances of this kind are few, and if there is any way in which a prospector may stretch his conscience it is in the exaggeration of mining prospects, in order to induce a backer to put up more money. This is, however, a part of the trade, and a poor prospector must live as well as the balance of humanity.

There is more than one class of prospectors. There is the prospector whose purpose is to make a strike and then quit. This has been called the professional prospector, but I do not think the term is well applied. The professional prospector is the one who makes a trade of it, whose ambition extends little beyond making a mere livelihood. Much of his time is spent hanging around town with a few rocks in his pockets, hunting a grub stake. He will work by the day and found, or on shares, and will sell his prospect hole at almost any price. He may work for a promotor, who always has on hand an assortment of mining propositions, groups of ten foot holes, each bearing some unique or high sounding name. He has partnership interests of shares in some stock company, and these he has by the ream. He has his prospectors near at hand so that they may corroborate his glowing descriptions and thus help through a deal.

Then there is also quite an army of amateur prospectors: people who have spasmodic attacks of mining fever, fit themselves out, and for a time scour the hills in search of hidden fortunes. But they soon get weary of the new life and its doubtful chances and return to their former haunts and former occupations. Some by a constitutional bent become enamored of the life, however, and stick to it. They like the wildness and ruggedness of the hills, the outdoor life with its health and freedom, and they become fascinated with the game of hide and seek with Dame Fortune.

Prospecting in the Rocky Mountains of Colorado can only be prosecuted, excepting in the lower foot hills, in the summer months. In the higher altitudes winter comes early and remains long and covers the mountain sides deep with snow. The gulches where mineral is found as well as upon the slopes are blown full of snow and sometimes buried deep by snow slides. Prospectors employed in these regions as a general thing repair to the towns during the winter where they manage to live until the snow is gone in the spring so that they may return to their work in the hills.

In some instances, however, they build themselves log cabins, and laying in a supply of provisions remain in the snowy regions all winter, hunting wild game as a pastime as well as the means of supplying their tables with animal food. But to most men such a life is too solitary and isolated from the outer world to be taken to kindly.

The prospector's outfit is rather a simple affair. For tools, he has a pick, a shovel, hammer and pan. If he proposes to search for more than surface indications, unless he be searching for placer diggings, he must have hammer and drills, giant powder and fuse. In the way of provisions he takes flour, bacon, coffee and dried fruits. Then he has a roll of bedding and a canvas tent. If he remains long in one locality he builds himself a log cabin from timber that usually grows in plentiful quantities in the mineral districts. He dresses in duck, and clothes his feet in stout shoes and covers his head with a broad brimmed felt hat, that shelters him about the face and neck from sun, rain or snow.

He works when he feels in the mood, and rests and amuses himself between whiles as his inclinations may lead. He usually has neighbors with whom he can visit, to exchange the gossip of the camp, play a friendly game of cards or swap newspapers, which in some way find entrance into most secluded spots imaginable.

THE ACID TEST IN BUTTER MAKING.

BY H. H. LYON.

In modern butter making, the "acid test," for determining when cream has come to the condition for making the best butter, is by no means an unimportant factor. It has long been known that the various changes in milk and cream, both those that bring the cream to the best condition for butter making, and those which tend to render milk and cream unfit for use, are due to the action of bacteria. Certain kinds of bacteria are capable of producing a bitter flavor in milk, others produce "ropiness," as it is termed, and still others induce the fine "nutty" flavor which is so much desired by butter connoisseurs. Butter which one buys at 30 or 35 cents a pound, is made from the same kind and condition of milk as that which is offered in the markets at fifteen cents per pound. The difference being due mainly to the kinds of bacteria that have been at work, and the extent to which the work has proceeded.

In recent years a new industry has grown up, viz.: The propagation and distribution of cultures which, when introduced into cream, will impart a fine flavor to butter. In some cases the culture is introduced as the cream comes from the separating machine, but in others the cream is first pasteurized. To pasteurize cream, it is heated by steam to a temperature of about 165° F., and for the most satisfactory work, it is kept at that temperature for about fifteen minutes. This process is supposed to destroy nearly all full-formed bacteria that have gotten into the cream, leaving the new germs, introduced by the culture, a clear field in which to grow and multiply. The method is analogous to that employed by a farmer who cultivates a field to destroy all weeds, and then sows a liberal supply of seed of the kind he wishes to grow.

When the culture is introduced into cream that has not been pasteurized, it is a race between the several varieties present, with the chances in favor of the culture, if it has a fair opportunity. But no matter how good the variety or how favorable the condition, if the bacterial growth proceeds too far, whether in pasteurized cream or "raw" cream, the fine flavor is spoiled, and to enable the butter maker to prevent this, the acid test comes into play. Various changes enter into the cream-ripening process, but the extent to which the process has been carried is determined by the amount of lactic acid developed; just as the degree to which the air of a crowded room has become vitiated, may be determined, experimentally, by finding the amount of carbon dioxide it contains. Lactic acid is formed from sugar of milk contained in the cream.

To determine the amount of lactic acid, a small sample of cream is carefully measured, and to it is added enough caustic soda solution of known strength to neutralize the acid. The reaction is given by by Prof. Wing as follows: Lactic acid, $HC_3H_5O_3$ + Sodium hydrate, $NaOH$ = Sodium lactate, $NaC_3H_5O_3$ + water, H_2O. The point where the alkali neutralizes the acid is determined by the use of phenolphthlein solution as an indicator. A few drops of the indicator are first added to the cream to be tested. So long as any acid is present the indicator gives no color, but the instant the acid is neutralized the pink color of the phenolphthlein asserts itself.

It has been found that fine butter cannot be made if the ripening process goes on to an extent indicated by more than 0.5 or 0.6 per cent. of lactic acid, and some of the finest butter for immediate use is made when the acidity is not above 0.37 per cent. Of course, everything must be in readiness when the proper degree of acidity is reached, for the cream should then be churned without delay.

In practice it has been found advantageous to incorporate the alkali and the indicator together in a small tablet, and, when used, five of these tablets are dissolved in 97 c.c. of pure water. These tablets are of such a strength that each c.c. of the solution used to neutralize the acid in 17.6 c.c. cream, indicates 0.01 per cent. of acid. For example, if 53 c.c. of solution are required to neutralize the acid in 17.6 c c. of cream, it is understood that the acidity of the cream is 0.53 per cent.

Cinematograph of Tidal Wave.

A cinematograph picture of the Severn Bore, believed to be the first moving picture of a tidal wave, was exhibited by Dr. Vaughan Cornish at a meeting of the Royal Geographical Society. The photograph is clear and sharp, and the peculiar motion of a tidal bore was accurately produced. The film is 150 feet long, and contains 2,400 individual pictures.

A New Light.

A wonderfully brilliant light has been produced, after six years' experimenting, in his laboratory, by Peter Cooper Hewitt, of New York. Every form of light now in use consists of heating some solid substance to incandescence, at which point it emits light, but which is then thrown off in the form of gas or vapor and lost. It was Mr. Hewitt's aim to find a gas that could be heated to the desired point of producing light, and thus to overcome the common defect of disintegration, which would result in a more satisfactory, and what is more important, economical light.

The new lamp consists of an ordinary glass tube, into which is introduced mercury gas, through which passes the electric current at 110 volts (ordinary incandescent light circuit). The current is connected to the gas in the tube at each end by fusing platinum wires through the glass.

It is necessary, when first turning on the current, to use a "booster," or device to momentarily give a high voltage to the current, at which point the gas acts as a conductor, and the whole tube is flooded with dazzling light. Mr. Hewitt stated that his light can be produced at one-eighth the cost of the incandescent lamp, and one-third the cost of the arc lamp, or gas. The light closely resembles daylight, but the red in the spectrum is absent; this may be an objection, but in some cases it is an advantage. In his paper read before the American Society of Mechanical Engineers, Mr. Hewitt says on this point:

"For shop-work, draughting, reading and other work where the eye is called upon for continued strain, the absence of red is an advantage, for I have found light without the red is much less tiring to the eye than with it. It is possible to transform some waves of this light, especially the yellow light, into red light, and thus in a measure to overcome this defect where required for general indoor illumination. A moderate amount of ordinary incandescent light interspersed with the mercury gas electric light serves to supply the deficiency, and the mixture may be made most satisfactory. For ordinary street-lighting purposes the mercury light is available even without the red, and it should be noticed that this light has very great penetrating power and seems to be effective through greater distances than an equivalent amount of measured candle power from the ordinary incandescent lamp. This may be due to the fact that the waves of the red light are less penetrating than those waves which are present in the mercury light, and hence the least valuable portion of the spectrum having such illuminating effects is omitted and the energy is practically expended in the more useful portions of the spectrum."

Lamps as large as three inches have been made, and as small as one-eighth of an inch; in fact, there seems to be no limit to the size or shape of the tubes.

OUR SEA-COAST HURRICANES.

BY THOMAS McCABE.

There are many causes that are conducive to the growth and intensity of a storm. One of these is the geographical position of the cities visited by the storm, and the topography of the surrounding country. In order to illustrate this idea, we must draw comparisons of cities situated on various parts of the American coast line, and draw attention to their surrounding topography and background, which in our view has such a modifying and restraining effect upon the growth and intensity of storms that approach them.

For instance, let us take the towns and cities of the Pacific coast, from Los Angeles to Astoria, or Portland, Oregon. They are comparatively free from destruction and devastation by storms, and yet there is no greater area on the northern hemisphere of the globe for the growth and movement of storms or hurricanes, than the Pacific Ocean.

As in the West Indies, so it is in the Philippines. In the neighborhood of those islands, hurricanes originate. Our storms recurve on the Atlantic or move by way of the Gulf of Mexico up the Mississippi Valley, and then follow the trend of other storms towards the Atlantic Ocean again. The eastern recurve on the Pacific Ocean, or move by way of China and Japan, until they regain the normal path of storms across the Pacific.

The great storms of the Asiatic seacoasts are generally denominated typhoons, and they move northeastwardly towards the western coast of the American continent, which they generally impinge on at about the 42nd degree of north latitude. These typhoons or hurricanes are of great magnitude and intensity in the far East, but lose a great deal of those characteristics as they approach the American coast. This is caused by the Sierras, and Rocky Mountain ranges, that run in a great measure parallel with the coast from north to south. It must be evident, especially to meteorologists, that the northeast wind is one of the great factors of cyclonic storms, especially when that wind has an unbroken run of some hundreds of miles before it reaches the vortex of the storm, because the longer its run is, the more material it gathers to add intensity to the storm. But as the Pacific storm approaches the American continent, its northeastern quadrant is not fed by those northeast winds to any great extent. The mountains are a barrier, and as such prevent their formation and development. There is, in fact, no indraft to the storm's progress, except the little afforded by the break in the Sierras at the Bay of San Juan Del Fuca, north of Portland, Oregon. And thus it is, that the upheaval of the Sierra ranges and the Rocky Mountains, has favored in a great measure the large cities, with their great centers of population, on the Pacific coast. For if these mountains were not in existence, the storms of the Pacific Ocean would swoop eastward and inland, with tenfold more force than they do to-day.

Long before their arrival on the Pacific coast, the southwestern trend of cloud-laden air coming from the northeast, would be established as far east as the western edge of the high pressure area that now dominates to a great extent the north central plain of the American continent, and the resulting conditions would be of a far more serious nature than is now experienced on the Gulf coast. This coast has no mountain ranges, and the local movement of the atmosphere incidental to hurricanes, or cyclones, has a full sweep in every direction, from Tampa, Fla., around to Galveston and Indianola, Tex. Hence it is that those cities are subject to those periodical disturbances that are so destructive to life and property.

The memorable Galveston storm, when first reported by the Weather Bureau, about the latter end of August, was quoted merely as a disturbance of no particular significance, and without any well defined vortex, but simply large moving banks of clouds, streaming in from the normal low belt of the Atlantic Ocean. It might properly be termed an offshoot of the equatorial rain region that had grown to gigantic proportians. It came by way of Martinique. and moving westward over the Caribbean Sea it was central on the 4th September southwest of Cuba, and its rotary wind was light at Cienfuegos, while at Havana it was but six miles an hour, emerging, as it were, from a rainstorm to a hurricane of cyclonic form, and up to this period its progressive movement could not be more than six miles an hour.

Northward, over a part of Lake Michigan, the pressure was 30.30, while the pressure in the Caribbean Sea south of Cuba was about 29.75. On the morning of the 5th of September it was central a short distance northeast of Havana, and had assumed a true cyclonic form with barometer falling to 29.64 and the wind increasing, and on the southeast quadrant 17 inches of rain had fallen in 48 hours in and around Santiago as per report of the Weather Bureau The pressure over the Lakes was fast diminishing, and also over the Atlantic Coast States; it being 29.76 to 30.0 over Lake Superior, and 30.20 to 30.30 over the Atlantic Coast from Charlotte, N. C. to Eastport, Maine.

By the morning of the 6th it was central off the southwest coast of Florida, or between it and Key West, with a somewhat similar depression of the barometer over the eastern waters of the Gulf as on the day previous. Northward over the St. Lawrence river a similar depression existed of 29 62 with an intervening pressure of from 30.10 to 30.18 over the Atlantic Coast States northward from Charleston, S. C. to the Chesapeake Bay; the highest pressure as noted above being at Elkins, W. Va.

With all these existing conditions, it looked as if the storm might move northward along the Atlantic Coast. Its supply of cloud matter was still coming from the south and southeast, while the rainfall was light, being but .38 at Tampa and .40 at Jupiter, Fla. The storm was in what might be termed a transition state, that is from a rain to a wind storm, and instead of moving northward up the Atlantic Coast, it moved westward, and on the morning of the seventh was central in the Gulf of Mexico south of Louisiana.

We may now ask: What were the causes that produced this recurvature from its normal and apparent path? The high pressure area of the Atlantic coast had lessened as the disturbance moved towards the Florida peninsula, and under ordinary circumstances these conditions would have opened a pathway for it. But the long drought that had prevailed over a large area of the United States between the 32nd and 42nd parallels of north latitude, from the Atlantic slope westward towards the Rocky mountains, had the effect of blocking the normal path of the storm. The air that lay listless, as it were, between the storm off the coast of Florida, and the rain area that extended on the night of the 5th of September trom Duluth, Minn., eastward to the Gulf of St. Lawrence, was dry. There was no electrical connection. The circuit was completely broken between the northern low of 29.62 and the storm center at Key West, and a somewhat similar depression of the barometer.

If we fail to recognize this all-important factor in atmospheric conditions, then we fail to comprehend one of the maxima of force units in the exhibit of all forms of atmospheric phenomena. The same, or nearly similar conditions prevailed on the 7th, only that nature made a greater effort at the north to connect her atmospheric conditions there with the great cyclone on the Gulf. There was a freezing temperature at White River and a pressure of 30.30, and a similar condition at Bissett, Ont., which filled the lower lake region with heavy clouds that were swept down from the northeast by way of Oswego, Rochester, Buffalo, Erie, Cleveland, Indianapolis and St. Louis; with velocities varying from eight to twenty miles an hour. It was the usual meteorological effort to run from high to low; but it failed, notwithstanding the fact that at the center of low on the Gulf, the barometer was down to about 29.50, making a difference of nearly an inch between the northern high and the southern low.

Those conditions fairly illustrate my contention that it was the drought which had prevailed so long over the corn belt of the United States, that prevented the hurricane of September in the Gulf of Mexico from moving north, either from its eastern, or central position on the Gulf. Hence its western trend towards Galveston. On the morning of the 8th it was central on the Gulf a little southwest of the city, perhaps 100 miles. The wind blowing from the north had increased from 12 to 22 miles an hour.

Directly north of the storm, from Palestine, Texas, to Little Rock, Cairo and Indianapolis, the air was still dry; there was nothing in it to increase the intensity of the storm. The cloudy condition of the previous day on the lower lakes had cleared away, but from the Caribbean Sea to the Bahamas, a steady stream of heavy clouds swept, curving around by way of Jupiter, Tampa, Macon, Montgomery, Meridian and Vicksburg, which, massing at or near Galveston, gave to the storm that growth and intensity which a few hours later on wrought ruin and desolation to the city.

These clouds in their rotary mechanical movement generate the vortex of the storm, and beget within such vortex the vertical spiral movement which gives to the cyclone or hurricane its greatest destructive qualities. This spiral movement carries the air aloft, accompanied with cloudlets of a cirrus form, which advance on high in front and advance of the storm, and herald its approach as they move with greater velocity than the storm in the surface strata of the atmosphere. As the storm crossed the Gulf of Mexico, the swell caused by its vortex and its progressive movement, was diffused over the great expanse of water, but as it approached the land, the swell became a flood wave, whose crest rose as it approached the land on which the city stood, because there was not room sufficient for the water to diffuse itself, as on the wider expanse of the previous day.

Therefore, instead of overflowing quietly over a large surface of water, it climbed upwards as soon as it met the obstruction and ascended, rising over the beach with a roar, and then up the slopes, through the streets, around the dwellings, until with the aid of the wind that was at least from 70 to 100 miles an hour, the water was piled up higher than ever before in the history of Galveston storms.

When the central vortex passed northward beyond the city the pull on the flood-wave ended, and the waters began to recede, or rather to sweep down from about 18 feet above the normal level of the Gulf; and it ran down this inclined plane with a force that no wind could mimic, rocking the dwellings as if in the throes of an earthquake. It was the advance and retrogression of the waters that produced that peculiar destructive quality of the storm, so graphically depicted by Prof. Garriott in the National Geographic Magazine of October, 1900, making altogether a storm disaster unprecedented in the history of the United States.

Now we may ask: Is it in the power of man to arrest the progress of a hurricane, to lessen its destructive force, or to dissipate it before it acquires the enormous force which was exhibited at Galveston, Sept. 8, 1900, or at Indianola, Sept. 15 and 16, 1876? Some people will smile at the very idea of coping with such forces of nature, and others will say, no; but the question will still remain unanswered, because of the few that are conversant with the mechanism of the cyclone, and then the large majority that know nothing whatever of either its mechanism, or the varying forces that give to it its energy, and its rotary momentum.

As already mentioned in this paper, the minimum force of the wind on the morning of September 4, 1900, was six miles an hour at Havana, and light at Cienfuegos. It was a weakling slowly struggling into existence as a cyclonic growth. It was in reality in an embryonic state; but the next day, the 5th, the wind was 16 miles at Havana and 22 at Cienfuegos. It was, so to say, commencing to robe itself in all its destructive paraphernalia. These were the hours when it could have been attacked with impunity, and with a fair chance of success. Had a couple of gunboats been in those waters upon either of those days, but especially on the 4th, and poured high explosives into the then forming vortex, it would have probably disrupted and dissipated the new cyclonic formation, and Galveston would have escaped the ruin and desolation that it afterwards wrought on the devoted city. Half an hour's firing would, I have no doubt, have proved the feasibility of a successful opposition to its further progress, as a cyclone, and in its stead, there would in all probability have been a further fall of rain, until the storm would have collapsed, or dissipated before reaching the coast of Florida.

The movements of a cyclone are all interdependent upon one another, and become as they progress in growth, a mechanism of air, water, attraction and gravitation, etc., and any interruption or dislocation of this mechanism reacts upon the whole of its component parts, and from these premises we may undoubtedly draw the inference, that a dissipation of a cyclone by artificial means, may be classed among the possibilities of the future.

Four Hours' Sleep.

The Chicago Board of Health and some lunatic asylum should look after the statement that a number of men and women in Chicago have formed a Four-Hours' Sleep club, which proposes to teach people that too much of life is spent in useless sleep. All members are pledged to sleep only 4 hours of the 24, and to bring up their children on that basis. They argue that all sleep in excess of this time is harmful.

Let the cranks sleep as little as they please, but the public authorities should rescue the children from slow murder. All medical authorities, and all experience teaches, that active childhood needs at least ten hours sleep, diminishing to eight at adult age.

Mounting Web of Spider.

F. W. Payne, in Science Gossip, writes, "I found no difficutlty in mounting spiders' webs in balsam. I painted a strip of varnish across the two ends of a clean slide, and held this flat against the web; the slide was covered with it, and the oblong torn from the web was held in position by the varnish. I added two or three strands of the big stays or cords supporting the web from the tree, and then left the whole to dry. A few days after I poured on the centre a little balsam dissolved in chloroform, then dropped a cover-glass on it, and left it to dry. The thinnest lines are visible, and the dirt (soot) on them more so. The hawsers, as I call them, show their multiple structure well. The lines which compose the cross threads of the net are smallest, but quite clear and simple. They are as visible in balsam as flax fibre is, and there is no tendency so far to dissolve.

Making One's Own Last.

A writer reports in the English Mechanic that he could get no last made that suited his tender feet, and says, "I filled a pair of worn-out shoes with plaster of Paris, and after it had set I cut away the tops of the shoes, trimmed the plaster casts, and had iron lasts cast from the plaster ones. I then put the iron lasts into a pair of new boots which I could not wear, damped the boot-tops, and hammered them gently, leaving them on the lasts until they dried. On taking them off, I found them to be a perfectly comfortable fit, just like old boots."

Brake for Ships.

The Montreal board of trade has lately had on exhibition a model for a contrivance to brake ships, so that they can be stopped almost instantly in case of threatened collision, or when a person falls overboard. The device consists of two or more doors on each side of the ship beneath the water line, attached outside to the sheathing and opening outward. By opening the doors on one side the ship can be brought around much quicker than can be done by rudder alone. The doors can be operated by electricity, steam or compressed air.

A Theory of Vision.

In place of the chemical theory, A Pizon has shown that in the visual organs of both the vertebrates and invertebrates, the pigmentary granules that accompany the visual cells are in rapid motion like that of micrococci. The presence of these granules in immediate contact with the visual cells and the constancy of their motions lead naturally to the conclusion that they serve as intermediaries in the excitation of the cells. The granules acquire their energy from the light and transmit it to the rods and cones of the retina. It remains to be proved whether the motion is cause or effect.

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PSYCHOLOGY AND BIOLOGY.

In a recent number of the Revue Scientifique, Vol. 16, No. 24, M Grasset makes an extended defense of the introspective psychology, as against the excessive claims of the psychophysiology now in vogue. He acknowledges the importance of the latter, within its limits and on its proper ground,—the study of the physiologic element in the phenomena of psychology. But, he says, it goes out of its domain and exaggerates its capacity, when, forgetting that it is at bottom only a chapter of physiology, it proceeds to invade, conquer wholly, and absolutely replace psychology itself. This is and remains a science apart, which has its methods of study, and its object distinct from that of biology. Its special source of knowledge is consciousness; it is interior observation, auto-observation. It is absolutely unscientific to deny this interior observation.

Is it curious, he asks, to see the facility with which the savants have faith in the veracity of their senses, that is to say, their organs of exterior experience, and the difficulty with which they admit the legitimacy of interior experience, which is, indeed, the beginning of all knowledge. The *ergo sum* of Descartes is the first scientific affirmation, and the condition of every other.

Whereas biology studies the laws of phenomena common to all living beings, psychology studies the laws of phenomena proper to man, not having analogy among other creatures. We recognize the notions proper to man, which psychology ought to study; they are the notions of good, of obligation, and of free judgment and choice,—all phenomena of intelligence proper. Psychic phenomena, however, include in a degree the inferior "psychisme" common to man and animals. The superior is peculiar to man, the consciousness of the good and the beautiful, and reasoning applying consciously the universal ideas, abstracting, deducing and understanding the wherefore. It is free decision, rational and responsible, involving merit and demerit. It is especially the science of the will and the conscience.

THE HEAVENS FOR FEBRUARY.

BY PROF. MALCOLM McNEILL.

February, 1902, will be rather a dry month for naked eye observations of the heavens and for users of small telescopes, unless a new star or bright comet or some other phenomenon not predictable should suddenly make itself manifest. Mercury is about the only planet in fair position, the others being too near the sun. The stars will, of course, be seen as they always are in February, but as the February constellations have been so often described before it is not worth while to do more than mention a few of the more prominent.

Ursa Major is high up in the northeast and Bootes is just rising. Virgo is rising in the east and above it are Leo, Cancer and Gemini, the latter on the meridian near the zenith. Canis Minor is in the southeast, and Canis Major is low down. Orion is the most conspicuous of the groups in the southwest, and Taurus is farther west. Auriga has just passed the zenith, and Perseus and Andromeda are lower down in the northwest. Cassiopeia is in the same quarter at about the level of the pole star.

Mercury comes to greatest east elongation on February 3, and at the beginning of the month does not set until nearly an hour and a half after sunset. This favorable position lasts only a few days, as the planet rapidly approaches the sun and comes to inferior conjunction on February 18. It is in conjunction with Venus on February 1, but the conjunction is not at all close, the latter planet being nearly 7° north. It is also in conjunction with Mars on February 12, passing about 4° north.

Venus begins the month as an evening star, setting about two hours after sunset; but it is rapidly approaching the sun and soon is too near for observation. It passes inferior conjunction on February 14 and becomes morning star. Its motion away from the sun is then so rapid that it can be seen with the naked eye in the morning twilight within a week after conjunction, and at the end of the month rises about an hour and a half before sunrise.

Mars is also an evening star, but is too near the sun and is too faint to been easily made out without telescopic aid. It will come to superior conjunction with the sun toward the end of March.

Jupiter and Saturn passed conjunction with the sun in January and are now morning stars, but they are not far enough away to be conspicuous, although both can be seen in the morning twilight. Saturn rises earlier than Jupiter and their distance apart increases from 8° on February 1 to 12° on March 1.

Uranus is also an early morning object, rising at about 2 A.M. on March 1

Neptune is in the western sky in the evening, but is too faint to be seen without a telescope.

The behavior of the new star in Perseus and its surroundings during the autumn has been of very great interest to astronomers This column, which deals almost wholly with phenomena visible to the naked eye, is perhaps hardly the place for an account of the doings of the "Nova," since they can show themselves only on photographic plates exposed in very powerful telescopes, but a few words may not be amiss.

The nova was discovered about a year ago, and within a very few days was as bright as any of the stars except Sirius. It soon began to fade away, and seemed to follow a course not differing greatly from other new stars. Its brightness diminished to a point below naked eye visibility, and the spectroscope showed an approach to the condition of a nebula. But during the early autumn months, photographs taken with the powerful reflecting telescopes of the Yerkes and the Lick observatories, showed that the new star was surrounded by a nebula. This nebula was not uniform in structure, but showed strong condensations of luminous matter in several places. The surprising part of the story is that photographs taken some weeks later show that these condensations have shifted their position very perceptibly. The motion expressed in angular measure, does not seem to be very noteworthy to the non-professional astronomer, but when account is taken of the enormous distance from us, the velocity in miles comes out fifty times greater than any hitherto observed velocity outside of the solar system. Whether it means an actual transfer of matter, or a transfer of energy through matter causing, as it were, a luminous wave, does not seem at all clear, and astronomers are awaiting farther developments with great interest. There are only a few telescopes in the world powerful enough to enable us to study the phenomenon.

Size and Density of Mercury.

Prof. Lee, of the Naval Observatory, at Washington, claims to have determined the diameter of the planet Mercury as 2,657 miles. In respect to density of the planets, he puts the Earth first, Venus second, and Mercury a little more than half that of the Earth. Prof. Russell, of Princeton, makes the density of the Algol type of stars about one-twentieth that of water.

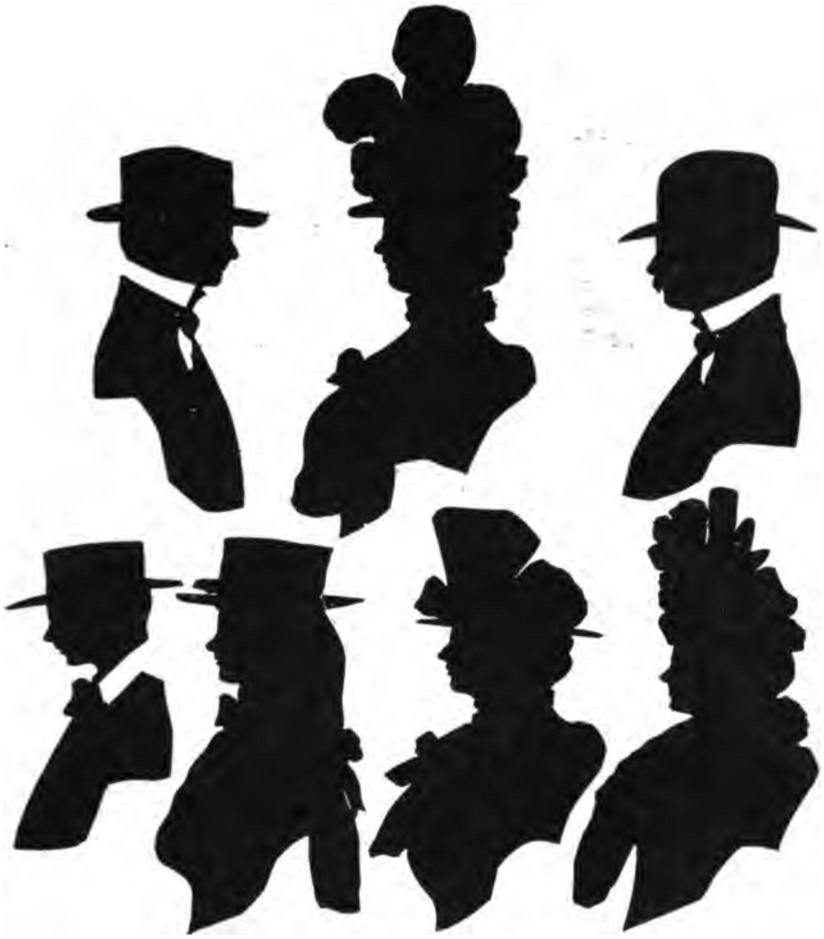
Rotation Velocity of Waterspout.

From photographs and measurements of a waterspout, Prof. Bigelow estimates the rotation at the surface of the sea as 354 miles per hour, which would be nearly six miles a minute.

SILHOUETTE PORTRAITS.

BY S. M. WINKLEY.

This art has been revived, especially in France, of late years, and collections have been made by those who are interested. It is wonderful how much is expressed by the outlines,—everything individual and characteristic of a person, as if by the vacancy he leaves in space,—his perfect presence by his blank absence,—the living by the disembodied, personality by a dark vacuum. The illustrations herewith, from a French journal, speak for themselves, and each individual tells his or her own story of feature, character and dress. In comparison, a photo is prosaic, leaving nothing to the imagination.



CHARACTER IN SILHOUETTES.

Under Louis XV, silhouettes had great vogue, and went by the name of "l'Art Noir"—the Black Art—a term better known as given to necromancy. It was taken up by the physiognomist Lavater in the last quarter of the 18th century, who professed with much reason that he could read character from them. It is said that beautiful women went in crowds to him, and that he was prone to flatter them. Göethe was fond of silhouettes, and Rubens did not disdain them; princes were among the persons delineated. Some artists devote themselves to the art, and are called silhouettists. M. Lampo designed a machine for the work, but abandoned his invention for the usual scissors. At the World's Fair in New York, 1853, a silhouettist rapidly cut very good full-length portraits in a minute, directly from the subject, that is, with no preparatory sketch. It is a *tour de force* of trained eye and skill, especially when there are delicate features to be copied.

The name is referred to Mme. Pompadour, and was given in a jest on M. Etienne de Silhouette, a French minister of state, who was much given to drawing charcoal sketches on the walls of his room. One might extract a moral from this art,—that we leave in the memory of others our distinct character when we pass into the vacancy of absence or darkness of death.

The Vital Force Electrical?

A late sensation is the claim of Profs. Loeb and Matthews that nerve stimulation, muscular contraction, and other processes of life, are due to the electro-positive charges of some molecules and the electro-negative of others. If so, it is an important advance in physiology. But it brings us no nearer to the origin of life, as certain quidnuncs are ever ready to assert. It is part of the bodily mechanism and action, behind which is still the Ego, and the Creative power that differentiates the various forms of life. Life is always *ab ovo*. A part of the above theory is that the nerves stiffen or gelatinize with every electrical excitation.

IONS, DISSOCIATION AND SOLUTION.

BY E. T. BREWSTER.

It is certainly remarkable how many brilliant, scientific discoveries of recent years have had to do with very simple and commonplace matters, which everybody supposed to be perfectly clear before. The X-ray is a case in point; and the new gases of the atmosphere, not to mention the knowledge which has come concerning the most carefully studied of all books.

So it is, curiously enough, only within the last ten or fifteen years that the chemists have come to understand so apparently simple a matter as ordinary solution: so that, for example, it is possible to make out just what happens when a pinch of common salt is added to a glass of water. Of course, the salt dissolves; but just what is dissolving? To explain this we have now the new "Dissociation Theory of Solutions," perhaps the most important contribution to inorganic chemistry of the last quarter century.

To understand clearly what happens when the cook salts the broth, it is necessary to turn aside for a moment to consider certain phenomena which have long been familiar to students,—the so-called dissociation of gases. Everybody knows that ice warmed sufficiently turns to water, and that water heated to one hundred degrees, Centigrade, boils away into invisible steam. Not every one knows that at temperatures above 1200, still another change takes place and the steam, ceasing to be water, separates into its two constituent gases, hydrogen and oxygen. Thus water cannot exist at all at high temperatures, since a mixture of hydrogen and oxygen uncombined with one another is not water. A proper reduction of temperature, however, will allow them to reunite into water as before.

Water, indeed, dissociates much less readily than many other substances. Solid sal-ammoniac, for example, heated gently, splits up into ammonia gas and hydrochloric acid, and on cooling the two recombine into the original solid. Or, to choose an example which should be remembered for its painful associations, dentists make their laughing gas by warming ammonium nitrate, which thereupon dissociates into laughing gas and water. In this case, however, as in many others, the two constituents cannot, by any known method, be made to unite again. Instances of such permanent dissociation on heating are common enough. The browning of cooked foods, the manufacture of charcoal and illuminating gas, the separation of various substances from petroleum, are familiar cases.

With this much by way of preliminary, revenons à nos moutons,—or rather to our mutton broth and its seasoning; common salt, as every school-boy knows, is sodium chloride. Sodium chloride moderately heated, is dissociated into chlorine and sodium; a property of which the school-boy takes advantage when, on occasion, he gets the ghasthly yellow flame of sodium vapor by burning salted alcohol. We have, at the present time, the best of reasons for thinking that the same dissociation into sodium and chlorine, which occurs when salt is heated, takes place, also, when salt is dissolved in water. That is to say, we believe that a dissolved solid is in very much the condition of an overheated oven. In a very dilute solution, one made by dissolving a small quantity of salt in a large body of water, this dissociation is nearly complete, and practically all the dissolved solid is present as free atoms of chlorine and sodium.

In all cases, however, we have to suppose that the atoms of sodium and atoms of chlorine, as they wander about through the fluid, are continually finding one another and reuniting into sodium chloride; and, on the other hand, that all the sodium chloride molecules are continually splitting up into sodium and chlorine atoms. The more concentrated the solution, the more frequently will atoms find one another and consequently the more frequent their union and the larger the proportion of the compound present. For this reason it is not possible to obtain the free atoms by evaporating the solution. For, as the solution becomes denser, more and more sodium chlorid is formed; until, as the last water dries away, the last atoms unite and all the original salt reappears.

The name "ion" is given to these dissociated parts of a dissolved substance, and we say that salted water contains molecules of sodium chloride and ions of chlorine and sodium. Not all ions, however, are single atoms, those of common salt to be sure are so, but the great majority of substances form at least one ion which is itself a compound.

The theory of ions has some curious practical bearings. It enables us, for illustration, to understand,—what nobody understood without it,—how soap assists in cleaning greasy articles. For the soaps are, of course, "salts;" in general the sodium or potassium salts of one or more of the fatty acids, just as common salt is the sodium salt of hydrochloric acid. In fact common salt may be made by mixing hydrochloric acid and soda lye, in the same way that a hard soap is made by mixing soda lye with fat. The way in which lye, when used for cleaning, "cuts" grease is obvious enough. The two simply form a soap, and the soap dissolves in water and sets free the included dirt: and, if we were not informed on the very best authority that good soap "contains no free alkali," we might well think that it acts in the same way. We used, indeed, to be told that soap acts only mechanically; now we know that as soon as the soap is wet it dissociates and the ions which originally came from the lye of which the soap was made are set free to form a new soap with the grease which is to be removed.

It must not be thought, however, that all dissolved solids are ionized. Sugar, for example, is not. In general the substances which dissociate in solution are either acids,—especially the strong mineral acids,—and so-called bases, like the alkalies, aqua ammonia and lime water; or "salts" such as common salt, saleratus, the vitriols, nitre, cream of tartar, and the rest. Other substances, as a rule, dissolve without dissociation, and apparently exist in water solution in the same state as in dissociated or recombined parts of sodium chloride.

So much, then, for the theory of ions as applied to cases of ordinary solution. There remains another important matter —the electrical relation of ions.

Let the reader recall three familiar facts. Many solids, notably metals, conduct the electric current, themselves undergoing no apparent change. Most fluids and many solutions are non-conductors. Solutions which conduct electricity, unlike metallic conductors, themselves suffer decomposition. To illustrate: a copper wire will carry a heavy current for years; a vessel of pure water will stop all appreciable current; a vessel of strong brine will conduct the current without much difficulty, but the water is continually decomposed into the oxygen and hydrogen of which it is formed, while the salt remains apparently unchanged. The matter is still further complicated by another anomaly. In perhaps the majority of cases where a solution acts as a conductor,—the various solutions used in electroplating, for instance, the dissolved solid is decomposed and the water remains unchanged.

In the light of the dissociation theory, however, all these conflicting facts fall into line. For, in the first place, it appears that in general only fluids or solutions which contain ions are acted on by the electric current or will conduct it; and in the second place, we have abundant reason for thinking that these ions are themselves electrically active. All this is most easily set forth in terms of the old "two fluid" theory of electricity.

According to the "two fluid" theory, each smallest particle of every body carries two charges of electricity of opposite sorts. Whenever the positive and negative electricities are present in equal amounts, they neutralize one another and produce no effect. But under certain circumstances, as in the plates of a battery or the coils of a dynamo, the charges are somehow torn apart and brought to different places, from which they flow together again over some conductor, and thus produce an electric current.

Now we have to suppose that each smallest particle of sodium chloride carries this double charge like other bodies, and that, when in solution the salt split up into ions, the electricities become separated also; so that the positive charge clings to the sodium ion and the negative charge remains with the chlorine ion. This division of the electric charge occurs in all cases of ionization, the positive electricity always sticking to the metallic ion.

Our salt solution, therefore, while electrolysis is in progress, has in it electrically mutual molecules of sodium chloride. positively electrified ions of sodium, negatively electrified ions of chlorine, and in addition the two metallic electrodes by which the current enters and leaves the fluid. Under these circumstances chlorine ions are constantly coming within range of the positive electrode and taking from it a sufficient positive charge to balance the negative charge which they carry. At the same time sodium ions are taking negative electricity from the other electrode and becoming electrically passive. Thus it comes about that a certain amount of electrical energy of one sort is being extinguished at one pole and an equivalent amount of the other sort at the other pole, so that it seems as if a current were actually passing through the solution. Clearly, however, the salt water is not "conducting" in any such sense as that in which a copper wire conducts, and the ionized solution falls into the class with other non-conducting fluids.

But sodium and chlorine ions, once their electricity is discharged,—like the prince set free from the enchantment of the wicked magician,—become at once our commonplace acquaintances again. Ordinary chlorine and sodium, however, will decompose water, the chlorine setting free the oxygen and the sodium releasing part of the hydrogen. Farthermore, the products formed by the union of chlorine and sodium with the different parts of water, themselves react on one another to form more water and the original sodium chloride. This new sodium chloride again dissociates and the process continues as before, so that it seems as if the salt were unaffected and the current were decomposing the water directly.

This transformation of ions into common states of substances is perhaps the more striking when the ions happen to be those of some of the familiar metals which do not decompose water. An electroplating solution, for example, contains, it may be, one-tenth of its weight of silver, copper, or nickel in that mysterious condition in which metals are soluble in water. But immediately the metal ceases to be ionized it is no longer soluble and appears as a metallic film on the surface of the teaspoon or bicycle bell which forms at once the negative electrode and the stage on which this transformation scene is enacted.

There is then no real difference between solutions in which the salt suffers electrolysis and those in which the water is decomposed. In neither case does the electricity really split up anything. In both the parts of the dissolved substance are ionized spontaneously and then changed back again into their ordinary state, and it depends only on the nature of the resulting substances whether the reaction shall stop or shall decompose the water.

Correspondence

Notes on Nest Linings.

Editor POPULAR SCIENCE NEWS:

You may notice that among birds of closely allied habits, no matter how much the outsides of the nests may differ, the linings resemble each other in texture at least.

We find very little nest lining among precocial birds for the simple reason that they do not need it

With the altricial birds it is different, for about the first thing an altricial bird does after hatching is to grasp the lining of the nest as firmly as its strength will permit. Then commences a steady movement of the feet, one grasps the lining, then the other; this only stops during sleep.

You will find the same principle at work among all our birds, the method changing, but the principle the same.

As soon as a young woodpecker is strong enough to move, he tries to climb the side of the nest-hole, and when partly grown will hang by hours to the almost smooth wood. This may account for the scanty nests of most woodpeckers; and for that matter some build no nest all, but lay their eggs on the bottom of the hole.

The nest lining, through the feet, tells much of a bird's life.

A firm, solid lining, you may be sure, was the home of a bird with strong feet and the feeding habits that demanded them.

With a knowledge of the feeding habits, we have made a long start in the study of our birds. If a Blue Jay should line her nest with down, like a Summer Yellow Bird (Chrysomitris tristis), the young jay would tear his home into shreds long before he was in a condition to leave it.

Among the birds of prey we find feeding habits that demand powerful feet; they have powerful feet, and were raised in nests lined with roots often as big as a pencil. These birds generally remain some time in the nest, and were it not for the coarse lining on which to exercise their feet, they would leave the nest with puny claws instead of powerful talons.

Birds are creatures of the air, but they must walk before they fly, so nature strengthens their feet and legs long before she gives them the use of their wings.

C. WILLIAM GROSS.

A Monster Fungus.

Editor POPULAR SCIENCE NEWS:

A short time ago a monster specimen of fungus was found in the mountains of Eastern Washington, by a party of men who were out hunting and prospecting. One evening the party camped in the edge of a small opening in the midst of a vast forest. The opening was over an acre in extent and nearly circular. About the center stood a very large snag of yellow fir, which, many years before, had been partly destroyed by fire, and was dead.

Near the ground a monster fungus had grown out from the dead trunk. It was much larger than a barrel, being more than five feet in diameter each way. By means of an axe the fungus was chopped free from the trunk. It was so large and heavy that four men were required to lift it from the ground. From all accounts this excrescent growth was the largest ever found on the Pacific coast. It was dry and almost as hard as bone, and was estimated to weigh not less than 600 pounds. As it was impossible to remove the immense fungus, it was finally chopped into big pieces, rolled onto the camp fire and consumed. It would have been an object of great interest had the men been able to bring it back where it could have been placed on public exhibition.

As to the age of this monster fungus, no one could form the least estimate. Evidently, it had grown since the tree was burned; but that might have happened more than half a century ago.

J. MAYNE BALTIMORE.

Something About Foam.

Editor POPULAR SCIENCE NEWS:

Why is it that foam and froth accumulate in streams in greater quantities during the night than in the day time? This is a fact, and some good reason exists for it. What is the true reason? Can any of the readers of POPULAR SCIENCE explain?

The same question has been asked me by a number of observant persons. I am frank to confess my inability to explain the reason for this fact. Presumably, it may be attributable to certain atmospheric conditions. But, I am not prepared to state what.

I have spent much time visiting the great Kettle Falls of the Columbia. There is a principal fall, and several hundred yards below, great rapids form where the vast volume of water is forced between high banks and over a mass of large ragged rocks. Both below the falls proper, and the rapids, the river is very deep. There are great swinging eddies.

During the night, immense masses of snow-white foam accumulate in these great eddies. I have seen banks of this foam three and four feet high, drifting around in the floods. Before the day is half gone, nearly all the foam has disappeared. Each morning there are masses.

Along the Kettle river I have observed the same thing. This stream is a wild, turbulent one. There are numberless rapids, below each of which are deep eddies. Early in the morning the stream is literally white with foam, at intervals for miles. With the advent of day, the foam begins disappearing, and by nightfall has nearly vanished. I have observed the same peculiarity along many other streams.

J. MAYNE BALTIMORE.

Two Strange Formations.

Editor POPULAR SCIENCE NEWS:

We have some remarkable rock formations in this state of Texas. Colonel Irons owns a fish pond near Red River, and after passing half a day at the resort, he and his party decided to enter a spring cave near the pond. The trip resulted in the discovery of a peculiar rock, which will cool water to a freezing temperature. After procuring a number of lanterns, they entered the cave through a long hall, along which a spring of water was running.

They first entered a large chamber, 25 feet wide and 50 feet long, with a ceiling varying from eight to sixteen feet in height. Passing on through a large hall, they discovered another room of about the same dimensions; and so on until they had passed through five rooms.

It soon became intensely cold, and when the party reached the sixth chamber they named it the ice-room. The walls of it were as cold as ice, and for a while some of the party insisted that it was ice. They broke off several large pieces to take out with them. The rock is a very light gray and slightly porous.

The mineral and oil discoveries of Texas are yet in their infancy. Future discoveries by the State Geological and Mineral Survey may surpass all others. North Texas may, in the future, become a great oil and mineral field, equal to Beaumont.

From San Francisco, Cal., it is reported that workmen on the great Southern Pacific tunnel, now nearly completed along the line of Los Angeles and Ventura counties, have discovered near there an immense rock that is a perfect image of a man's head. A photograph was taken of this strange freak of nature by one of the workmen, who had a camera in his possession, and it was sent to Chief Engineer Hood of the Southern Pacific, at San Francisco. The photograph has been shown to a number of gentlemen and they all believe that there is no other rock in existence that is such a perfect representation of a human head. This rock will no doubt be looked upon in the future as one of the points of interest in California. America has a sphinx that is just as imposing as that of Egypt, and this sphinx of California is older than that of Egypt, for it was not made by man, but formed by nature. This singular rock is on Chatsworth Park rancho, and is the property of Mrs. Johnson.

WM. L. MOORE.

Submarine Channel Line.

M. Goubet, inventor of the submarine boat bearing his name, says that a syndicate was being formed to establish a submarine line between Calais and Dover. A cable would be placed 45 feet below the surface of the channel, along which submarine boats 90 feet long and carrying 200 passengers, would travel. He expects that the passage will be made in from twenty to thirty minutes.—Sun.

Questions and Answers

QUESTIONS NOT ANSWERED.

Answers are solicited, especially for all questions so far without replies. Questions will appear but twice, successively. Those unanswered will then be designated by numbers. The following, need reply —297, 309–11, 318, 321–322.

321. Sound of Steam Pipes. How can the hammering sound of steam pipes be prevented? And what is the cause?
G. N.

322. Do Fish Sleep? This is affirmed by some and it is denied by other observers
PISCATOR.

325. Images of Buddha. Where can I find examples of the alleged Mexican images of Buddha, and what is the evidence that they are verily such?
J. J. S.

326. Weather Forecasts. Why is it that so many of the official forecasts fail?
FARMER.

327. Raw Colors. When I use a set of colors in painting the effect is raw and unnatural. Why is it?
EUGENIA.

328. Colors and Complexion. For a sallow complexion what colors should be worn near the face to correct the defect?
EUGENIA.

329. Waterproof Glue. How is this prepared?
Y. Z.

330. The Great Halo of Helvetius. This is said to have been seen but three times, before observed in Cleveland last December. It is a solar halo of 90° radius, that is, half the sky. Have your readers ever seen it?
R. T.

331. Animals as Weather Guides. Is it true that the actions of any animals indicate the coming of pleasant or stormy weather?
T. S. W.

Non-Slipping Shoes. Is there such a thing known in the market? Even the soles of india-rubber overshoes become very smooth, and slip on smooth surfaces.
AGE.

333. Multiple Telegraphy. How can two or more operators use the same wire? I can conceive that many systems of waves can be simultaneous, but how about the mixing up of dots and dashes received?
WILLIE.

334. The Gyroscope. My teacher explained this, but I cannot understand why the revolving wheel must keep itself vertical.
PUPIL.

335. Safety in Cars. What is the safest car as to its position in a train?
D. M.

336. Worn Eyeglasses. Mine become worn by carrying them in pocket or case, so that the centres are almost like ground glass. How can they be polished again without further damage?
MRS C.

337. Permanent Marking Ink. Could you oblige me with the name of a permanent marking ink for use with a rubber stamp on linen; I have tried several, but they have all been failures.
W. S.

ANSWERS.

284. Why do Plains Cattle Dislike a Man on Foot? It is not probable that they do dislike him, any more than they do any other strange animal they feel they may have cause to fear, and want to run out of its range. The man on horseback is equally obnoxious to them, but appears too big a combination to tackle; so they do not. Plains cattle familiar with men on foot, show no special dislike.
F. S. MATTESON.

284. Why do Plains Cattle Dislike a Man on Foot? Range or plains cattle become so used to the cowboy and his horse that a man on foot is an object of curiosity to them. To satisfy this curiosity, they will crowd around him, the cattle on the outside forcing those nearer to such close quarters, that the pedestrian is in danger of his life. If he attempts to run they will invariably follow, just as domestic cattle will sometimes follow a retreating dog.
J. W. SHIPLEY.

285. Why are Indians not Baldheaded? Some Indians, it should be. The answer that they do not wear "warm, stifling head-covering" is not logical. Indians do cover their heads, and many times wear warm, stifling, and fancy head covering. That they "do not cut their hair," is incorrect. Many Indians do cut off their hair. But I conceive that they are not subject to baldness—as white people are—for the reason that they are Indians. One might as well ask why they are not white. Indians are much nearer the animal than the white race.
F. S. MATTESON.

287. Flycatchers and Snake Skins. The nests of almost all small birds that build in trees are subject to robbery by crows, squirrels, hawks, owls, etc. A snake is the common enemy of both birds and small animals. The flycatcher profits by this in using cast-off snake skins in the structure of its nest, as neither squirrel nor crow would care to approach ever so tempting a morsel apparently within the coils of a snake. Probably the ancestral flycatcher discovered this means of protection for her nest by the accidental use of a snake skin in constructing it.
J. W. SHIPLEY.

296. Why does a Dog Bark in Pursuing its Prey? I conceive it to be hereditary instinct not yet bred out. All dogs do not bark, in pursuit. I had one which not only pursued silently, but would watch and creep, as stealthily as any cat. The wolf—the wild dog—pursues and attacks, in combination with its fellows. He operates a trust, or a labor union, and shouts to his fellows to come and help.

I have been the object of their pursuit myself, and have some knowledge of their methods in pursuing other prey. The wolf is a born coward, and appears to want his intended victim to run. He being strong of wind and limb, appears to know that when his quarry is exhausted by physical effort, it will fall an easier prey. In this he is wise.

Again: your dog barks at the stranger to warn you of his approach, and to warn the stranger away. He does this for his master's sake; not for his own.

The rattle of the rattlesnake is not notice of attack or pursuit. Rattlesnakes never pursue. It is a warning to keep off. "Leave me alone or I'll bite you." And if not trespassed upon the rattlesnake is harmless
F. S MATTESON.

297. Flocks of Birds Flying. The question concerns a remarkable fact. The only way I can account for it is that the movement is quickly propagated through the flock from the leader or leaders, each bird influenced by the movement of the bird next before him and instinctively keeping at proper distance from him and the individuals on each side. It would seem that there is also a sympathetic rhythmic beat of the wings in the flock, so that the white wing-lining of all the birds shows at the same moment, or successively, in changing course of flight.
S. T.

303. Hair a Vital Drain. This appears to be one of the many whim-whams that occur in the periodicals. Cutting the hair close "in the 7th or 8th year of the child," or at any time, tends rather to make it more coarse (as we know by the effect on young beards,) and so perhaps maintain or increase the amount of nutrition required, which is not great in man for this end, anyhow. Sampson could be quoted, but it might have been the moral effect on him when he broke his vow and lost strength, after the clipping of his hair. Women, certainly, are not to be tested in strength by the length of their hirsute growth. And the foot-ballers can hardly be weakened by the growth of shaggy locks; nor lions and other hairy animals.
MEDICUS.

308. City Plants Sleepless. I have been been taught to believe that animals both sleep and rest, and that plants simply rest. By referring to the dictionary, I find that sleep is thus defined:—"A temporary suspension of the thinking powers."
TIMOTHY WHEELER.

323. Movements of a Crowd. It is about as puzzling as that of a flock of birds, and is a frequent vexation. One wants to shout "move on there ahead—step lively." In emerging from any audience room, especially from a church, there are thoughtless persons in front who block the exit by stopping to gabble with acquaintances. But there, and still more when a crowd is leaving or entering a rail-car, it is the bunching up of those in the rear that compels slow motion, doubtless, lest each impinge too much on others; for I have sometimes looked ahead and seen the individuals in front stepping forward lively enough.
S T.

324. Date of Mammoth. No one knows anything about 100,000 years. The date of the Glacial Period has been given variously by men of science after studying Niagara river and other chronometers where erosion is shown since the glacial deposits. C. H. Hitchcock's recent study of the Niagara allows 10,000 years or so, if I remember rightly; before that some had given six or eight times that. Of geological time we only know that it was very long, but nothing that can be expressed in definite figures with any certainty. The sensational papers, and sensational scientific persons who furnish information to such papers, must do the big thing, of course, in Munchausen style.

GEOLOG.

326. Weather Forecasts. Much criticism is visited on the government forecasters, and often in a spirit of humor. But the usual 80 per cent. of predictions verified is quite as much as could be reasonably expected. Many persons do not seem to have even an inkling of the fact that a rainy low-barometer area, or a dry area of high pressure, may and often does change its course, and expand or contract; or even quite disappear. On our Atlantic slope, not a little depends on conditions of the atmosphere over the ocean, where there can be no weather stations. The conditions there may increase or diminish a storm, prolong or shorten its continuance, and may change its course.

Any one probably can have for a month the daily weather maps of the U. S. weather bureau at Washington, and studying these from day to day, he will be enlightened, if he is capable of interpreting the plain indications given of barometer, temperature, direction of wind, all connected by lines and showing the progress of weather areas across the country, with their changing extent and intensity.

OLD PROBABILITY.

327. Raw Colors. 328. Colors and Complexion. Because there are no raw or crude colors in nature. The eye observes what the hand fails to transcribe. Being able to recognize the crudity of one's work indicates that the eye is better educated than the hand; and for this reason some intelligent experiments are necessary.

There being no crude colors in nature, we cannot represent her in her ever varying moods by using them; and in order to avoid attempting to do so, must frequently proceed in opposition to our alleged knowledge of things in portraying her. Thus: There is a barn in the distance which we know is painted Indian red. If we represent it in our picture painted in pure color, it will not seem natural. At this season of the year we are tempted to paint snow scenes; we know that snow is white, and when we carry out our knowledge in this respect and represent the broad meadow with its immaculate mantle, with pure white paint, it looks raw and lifeless. In fact it is.

The sky is not blue, grass is not green, the field of ripened grain is not yellow, nor the field of snow white, neither is the red brick building red; all colors are modified by intervening atmosphere, reflection of light from surrounding objects and the sky, by the contrast of juxtaposing colors, and to these may be added, imperfect translation. The key to the situation, then, is: Use only compounded tints, which are all mixtures of red, blue and yellow, or their equivalent.

Upon your palette place a mass of white, tint it with Indian yellow; neutralize this with red Naples yellow, and then bring it to a nice atmospheric blue. If the mixture is too dark for the sky tint, reduce it with white, if not luminous enough, add more yellow; if not warm enough, more red; if not cold or dense enough, add blue. Now every color in the landscape is prepared on this principle; the yellow and blue predominating to represent herbage; red selected according to requirements. To portray a red brick building for instance, add blue, for sky reflection; select, according to requirements for a blue apron or dress. A dark mixture of the three will do for shadows. The colors here suggested, like certain musical tones or a scale of odors, are high; lower ones are needed in producing other effects; therefore, continue experimenting down the scale. Try yellow ochre, light red and permanent blue; then, brown ochre, caput mortuum and cobalt; raw sienna, Indian red and Prussian blue; and raw umber, dark caput mortuum and Prussian blue. Black may be added to any of these mixtures for deeper shadow.

Burnt sienna being orange, takes the place of red and yellow; terra verte is a most useful color and replaces blue and yellow, particularly in flesh tones; raw umber and Prussian blue or yellow ochre and ivory black, make harmonious greens, being brought to the proper tone by admixture of white or light neutral mixture.

Red, blue and yellow are called primary colors, and except in the hands of a master are always crude. Mixtures of them, orange, green and purple, called secondary colors, are more harmonious; but of those made from these: orange and green, give olive; orange and purple, brown; and green and purple, neutral gray; these, called tertiary, are the most harmonious.

The harmony of contrast is most perfect when a mixture of two colors is placed beside the color not present in the mixture. Thus: green (blue and yellow), is the complementary of and accentuates red, and, is in harmony. Purple (red and blue), is in harmony with yellow for similar reason. Hence, to kill the yellow of a sallow complexion oppose it by orange, that is, any warm tone part of which is yellow. The background of a portrait will have a neutral ground brought up to green on one side of the head, to contrast the warm reds of the flesh, and shading to a tone of burnt sienna on the other, lighter side, to absorb the yellow. Study, "Hints on Sketching from Nature," N. E. Green. Part 3. Color. Geo. Rowney & Co., London. Obtainable of dealers in artists' materials.

F. M. GOODMAN.

University of Illinois.

CURRENT NOTES.

The Eccentric Asteroid.

The unexampled eccentricity (0.38) of the planetoid lately discovered at the Harvard observatory station in Peru, is questioned by an English astronomer.

Mosquitoes in Winter and Afar.

Prof. Smith, of Rutgers College, finds Anopheles larvæ in ice-covered ponds, and the adult hibernating in groves; and that Culex travels twenty miles at least.

Spontaneous Ventilation.

French scientific journals report that a small room renews its air through the walls in an hour, with 25° difference between the outdoor and inner temperature.

Pygmies in Europe.

Prehistoric remains of a midget race have been found in Germany, Switzerland and the Pyrenees. None of the skeletons is longer than 55 in., and many are smaller.

Sandstorm in California.

The recent sandstorm from the Mojave desert is said to have piled up sand in Santa Ana 30 feet. This illustrates "The Great Dust Age" in our December number.

The Smallest Vertebrate.

The Mistichthys luzonensis of the Philippines averages a half inch in length. This fish is scooped up in quantities and used as food. It belongs to the goby family.

The Vermiform Appendix.

Dr. Hershey, chairman of the Colorado State Medical Society, finds that the vermiform appendix, so notorious in appendicitis, is a secretory organ, furnishing lubrication important in its place.

A 500-mile-per-hour Locomotive.

Mr. A. L. Russell, of Boston, believes that this rate could be reached by big drive-wheels. A driver 16⅔ ft. high, making 11 revolutions in a second, would cover 375 miles in an hour.

Danger of Railway Crossing.

Our common schools should teach the simple fact that a 7½ ft. drive-wheel, running at 60 miles per hour, makes 110 ft. a second; at 40 miles, 77 ft. It takes several seconds to cross a railway track.

Why Hair Turns Gray.

M. Metchnikoff ascribes this to a bacillus that consumes the coloring substance; he names it the pigmetophagus. Low vitality from any cause favors its multiplication.

Benzozone.

A name given to a new intestinal antiseptic by its discoverer, Prof. Novy, of Michigan University, and believed to be a sure preventive of cholera, typhus, dysentery, etc. The Tribune reporter talks of the germs of these as "animal organisms."

Phosphates in Palestine.

The Sacred Land, long given over to barren desolation, may yet blossom as the rose. Rich deposits of phosphates have been found in the regions of the Jordan and the Dead Sea.

Intelligence of Ants.

In the American Naturalist, Professor W. M. Wheeler concludes that it is quite unnecessary to assume the existence of anything beyond instinct and simple intelligence in the ants which form compound and mixed nests; there are no evidences of ratiocination in ants.

A Thinking Will.

At the annual meeting of American naturalists in Chicago, recently, the papers read indicate, says a reporter, that a good many believe that, in order to be influenced by anything in or connected with the body, there must be something distinct from the body to be influenced; also, if there be a thinking will in man, there must be a thinking will in the world.

Murder by Telephone.

Report says that the manager of an electric lighting station at Mascara, Algeria, noting that his telephone was out of order attempted to disconnect the instrument to find out what was the matter. He received a violent shock which caused him to fall senseless to the floor. It was afterwards discovered that a discharged workman, in an attempt at revenge, had connected the message wire with an electric light wire on which there was a current of 10,000 volts.

Snapshot X-ray Apparatus.

An X-ray photograph can now be taken in one second, instead of the tedious and exhausting exposure of from half an hour to sometimes two hours. This is the invention of Dr. H. P. Pratt, of Chicago. One of the greatest features of the new discovery is the aid it gives the surgeon in critical cases, when a patient is very ill or nervous, and long exposures frequently resulted badly.

Marconi's Electric Waves.

Professor Fleming, lecturing before the Royal Institution, said he had been comparing light waves with electric waves and found they were both waves in the ether, which bent around obstacles they encountered. They travelled at about the same speed of 186,000 miles a second. Marconi's transatlantic waves were about 1,000 feet long, not very small compared with the obstacles they had to encounter; that is, the hill of water formed by the curvature of the earth, which he calculated was about 110 miles above a straight line joining the Lizard and Newfoundland. The bending required, therefore, was not great compared with the distance, being arable to a wave one-hundredth of h in length bending round an ob- one-fifth of an inch high.

New Light on Drowning.

The idea that drowning persons take much water into the lungs has seemed to be unquestioned. But it has been long opposed by Prof. W. K. Whitford, who in 40 years has successfully treated many patients apparently dead from drowning, and who now asserts, as the result of many examinations, that practically no water enters the lungs.

Developing Plates.

Developing plates in cold solution will give thin negatives lacking in detail, owing to the fact that only a portion of the chemical action is utilized, as much of the energy is neutralized by the low temperature. Under ordinary conditions, much the same results follow under development, showing that using too cold a developer is virtually under-developing.

An Ice Age Coming?

Sir Robert Ball is reported as saying that the cause is a certain configuration of planets and the precession of the equinoxes, occurring every 80,000 years, when the summers are very short, the winters very long. This is theory, and but one of many theories, right or wrong. Slight geological evidence for it.

Facts Before Theory.

Dr. Ira Remsen, the eminent chemist, now president of John Hopkins University, in a recent address at Boston, argued against making students in chemistry face and master the atomic theory before they know the elementary facts of chemistry. He would omit from elementary textbooks all reference to that theory.

Platinum in Klondike.

The Canadian government metallurgist reports that in the millions of dollars worth of gold brought from the Klondike the last season there was a liberal sprinkling of platinum, including many fair-sized nuggets. It is said that many of the miners have been sorting out the platinum and throwing it away as worthless, whereas it is worth 50 per cent. more than gold.

Serum for Snake Bites.

Dr. Chalmette, chief of the Pasteur Institute, at Lille, asserts that one woman, who was bitten in India, was restored when at the point of death by his serum. It is stated that Dr. Chalmette saved his own life with the serum, he having been bitten by a cobra from which he was extracting its venom, which is used in the composition of the serum.

Green Fog Lights.

Experiments at San Francisco harbor with variously-colored lights are reported as showing that green is the most penetrating color. This is remarkable, seeing that the long red waves are those that penetrate the mists of sunset, coloring the setting sun.

BOOK NOTICES.

Studies of Trees in Winter: A Description of the Deciduous Trees of Northeastern America. By Annie Oakes Huntington, with Introduction by Charles S. Sargent, LL.D. Boston: Knight and Millett. 1902. Pp. 198. Illustrated. The name of author, and the introduction by Dr. Sargent (director of the Arnold Arboretum of Harvard and author of the Silva of North America) give authority to this handsome volume. It has nearly 80 beautiful page-plates from photographs, including ten finely colored. With these, and the text, the reader will be able to identify our forest trees, carrying on his botanical studies in the leafless and flowerless winter; the artist will get many useful hints; and the farmer and woodsman can test their knowledge. It was a happy thought to make us acquainted thus with our brethren of the forest,—an acquaintance which is ordinarily very limited.

Familiar Trees and their Leaves, Described and Illustrated by F. Schuyler Matthews. With Illustrations in Colors and over Two Hundred Drawings by the Author, and an Introduction by Prof. L. H. Bailey, of Cornell University. New York: D. Appleton & Co. 1901. Pp. 320. The twelve colored prints of trees enliven much this excellent book; and the photographs are helpful, while the numerous drawings of leaf and fruit are faithful and artistic. These and the descriptions leave no excuse for error in identifying our trees. Prof. Bailey well remarks that it is of interest to all persons, not botanists only, to be at home in this ready way in our sylvan surroundings. The first chapter fitly treats of the leaf as a builder. Prefacing it is a tabular key for the other chapters, which arrange trees according to their leaves as simple or compound, with or without teeth, divided or not, etc., thus rendering it easy to find the name and description in the text. With this and the book on trees in winter, one ought to be very familiar with the varied forms of the forest and roadsides.

What Are We Here For? By F. Dundas Todd. Chicago: The Photo-Beacon Co. 1901. Pp. 142. The author seeks to promote individual and collective effort for the advancement of the human race. He treats of education, work, disease, war, commerce, morality, religion, etc. His theory of religion and morals is utilitarian, and he presents his definition of morality, "the product of coöperation," as an antidote to anarchism.

The Bird Rock Group. By Frank M. Chapman. Supplement to American Museum Journal, Vol. I, No. 11. This pamphlet by the Associate Curator of mammalogy and ornithology, illustrates with many fine photographs the highly interesting groups of water-birds on imitation rocks, in the museum, with pictures also of natural habitats from nature.

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Jonathan Hutchinson, F.R.S., General Secretary of the New Sydenham Society, has requested Messrs. P. Blakiston's Son & Co., of Philadelphia, the American agents of the Society, to announce the publication of "An Atlas of Clinical Medicine, Surgery and Pathology," selected and arranged with the design to afford, in as complete a manner as possible, aids to diagnosis in all departments of practice. It is proposed to complete the work in five years, in fasciculi form, eight to ten plates issued every three months in connection with the regular publications of the Society. The New Sydenham Society was established in 1858, with the object of publishing essays, monographs and translations of works which could not be otherwise issued. The list of publications numbers upwards of 170 volumes of the greatest scientific value. An effort is now being made to increase the membership, in order to extend its work.

Doubleday, Page & Co. are issuing a superb set of books under the title of "The New Nature Library," which are designed especially to help those without scientific training to comprehend the beauties and wonders of nature. These books are quartos and are very cheap when the size of the books and the many beautiful illustrations are considered. The illustrations in these books have created a new epoch in producing colored pictures directly from photographs of natural objects.

◆

Antiquity of Anæsthetics.

A Chinese manuscript lately discovered in the Paris library proves that anæsthetics were used in China 1,700 years ago. A certain concoction, it states, was given by the doctors before performing an operation which rendered the patient unconscious. The anæsthetic was a simple preparation of hemp.

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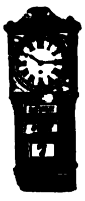

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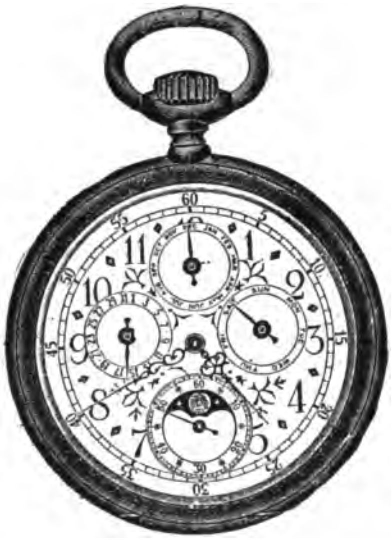

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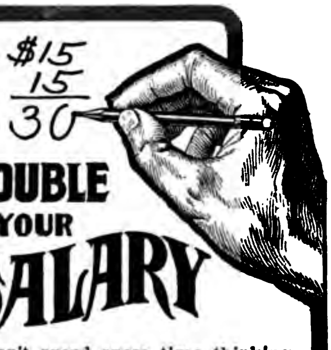

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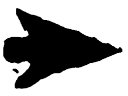

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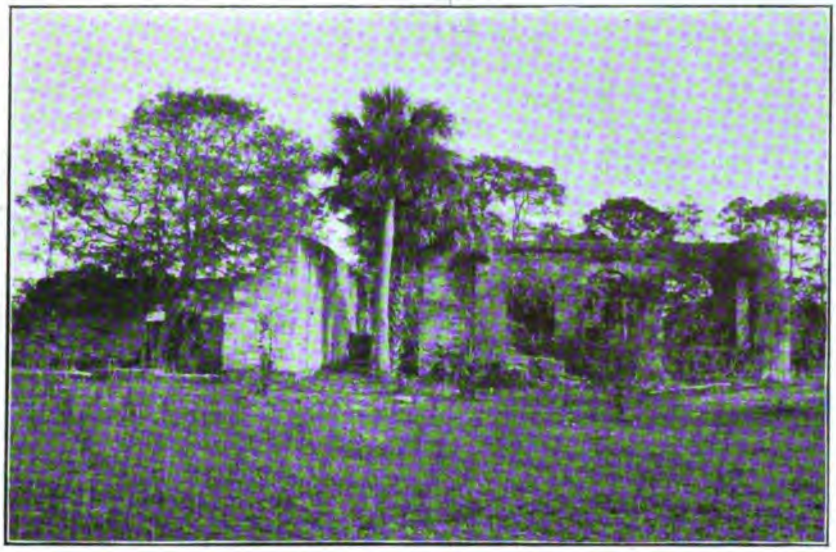


RUINS AT NEW SMYRNA, FLORIDA.

RUINS AT NEW SMYRNA, FLORIDA.

BY JOHN P. MERWIN.

New Smyrna is one of the oldest settlements in Florida. Shell mounds and barbaric implements are found, proving its early occupation by Indians, and there are numerous ancient ruins, probably of Spanish construction, but concerning which nothing definite is known. The pictures are of a very old ruin, said to have stood nearly 300 years; it is made of the finest coquina rock, a natural shell concrete. No. 1, front, looking east; No. 2, side view, looking south. Dr. Andrew Turnbull manufactured indigo there, and later the building was used as a sugar mill.

Authentic history begins in 1767, when, it is related, Dr. Andrew Turnbull, an English gentleman of fortune, entered upon the gigantic task of draining the low hummocks back of New Smyrna, and making them fit for cultivation. He had satisfied himself of the wonderful richness of this tract, and preliminary surveys had proved the possibilities of drainage. This was four years after the cession of Florida to Great Britain, and the English were fast learning that they need not depend on provision ships for the necessaries of life.

"Turnbull procured a grant of 60,000 acres from the Governor, on condition that certain improvements should be made within a specified time. He then sailed to the Mediterranean, and secured permission from the authorities to transport to Florida a large number of Greek families. For this permit he paid £400. Most of the Greeks were from the Peloponnesus. The number was further recruited from the Balearic Isles, and in the end some fifteen hundred persons—men, women and children, emigrated under his leadership. On his part free transportation, with good provisions and clothing, were guaranteed. If any were dissatisfied at the end of six months, they were to be sent home, but those who remained and worked for three years were to receive 50 acres of land for each family, and 25 acres for each child.

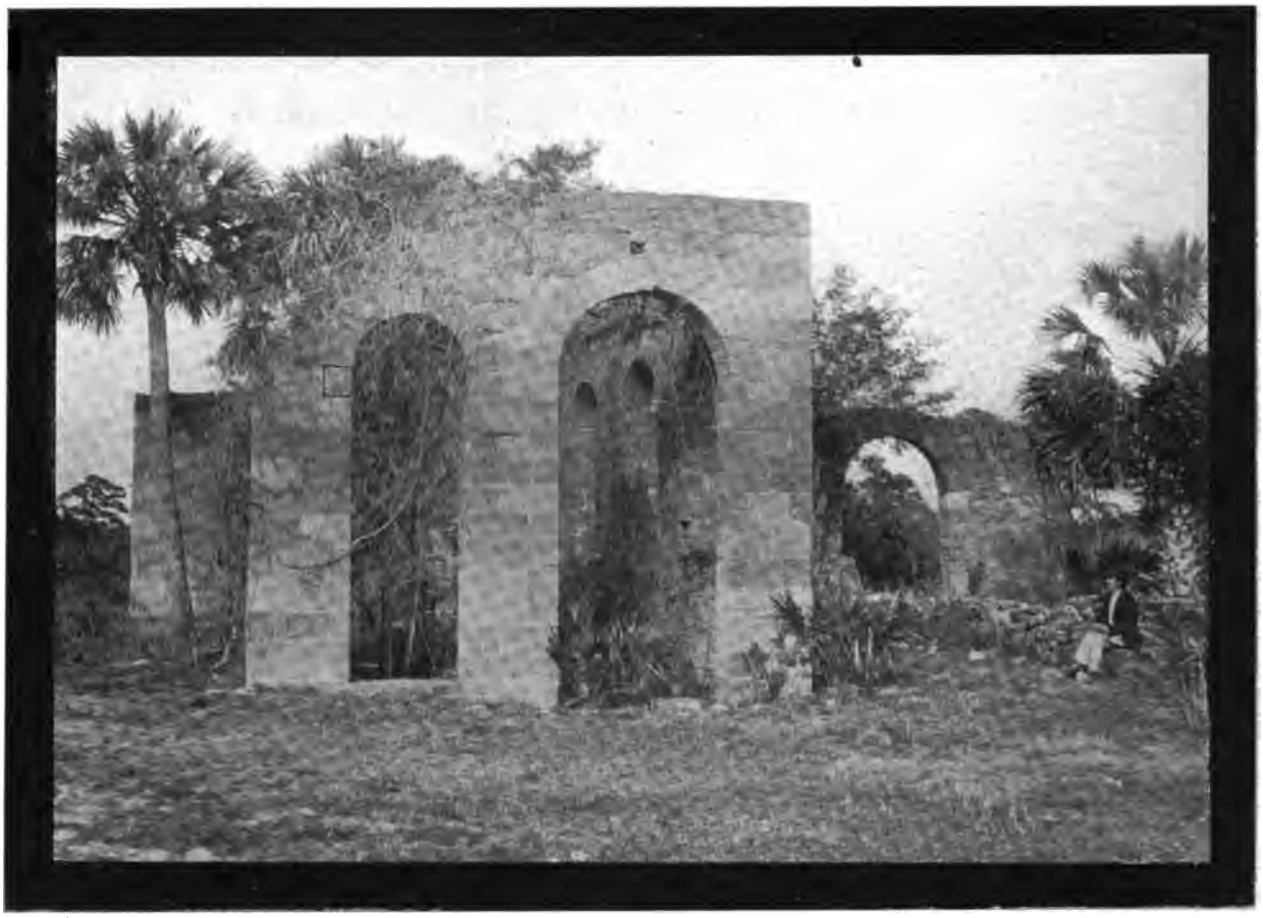
The voyage proved long and many died on the passage, but the survivors began work with good courage, built palmetto huts for the approaching winter, and planted crops that yielded full returns in early spring As soon as it was certain that the colony was secure against hunger, Turnbull planted indigo. In 1772, about 3,000 acres were under cultivation, and the net value of the crop was £3,174.

Success seemed assured, but for some reason the management of affairs was left to agents, who inaugurated a system of oppression that soon became absolute slavery, with all its revolting features. By 1776 only 600 of the colonists were left. In the summer of that year a party of Englishmen from St. Augustine visited New Smyrna to see the improvements, and while conversing among themselves, their comments on the state of affairs were overheard by a bright Minorcan boy, who immediately told his mother what he had heard. Secret meetings were held, and a plan was concocted whereby a party of three of the bolder spirits were granted leave of absence to catch turtle. Instead of going south, however, they started up the coast, swam Matanzas Inlet, and, reaching St. Augustine, appealed to the Governor for protection, which was promised.

The envoys returned to New Smyrna with the tidings of release. A leader was chosen, Pallicier by name, and under his direction the able bodied men provided themselves with wooden spears, rations were packed for three days, and with the women and children in the center the six hundred began their march. So secretly was all this managed that they had proceeded several miles before their departure was discovered.

No attempt at forcible restraint was made, though it is said Turnbull himself waylaid them before they reached St. Augustine, and endeavored to persuade them to return. They marched on, however, and reported to the Governor, who ordered provisions for them, and organized a Court for the trial of their cause, the Attorney-General of the Province, Younge by name, appearing as their counsel.

Turnbull failed to establish any further claim upon their services, and they were



FRONT VIEW OF THE NEW SMYRNA RUINS.

assured of personal liberty. Lands were assigned them, and they soon became an influential element of the population in St. Augustine. Some of their descendants are still to be found in the neighborhood of New Smyrna, where they returned after they became assured that there was no danger of re-enslavement.

New Smyrna is on the eastern coast of Florida, about 90 miles by rail south of St. Augustine, on the line to Palm Beach, and one-third the distance from the northern boundary of the State to the end of the Peninsula. A temperate climate prevails in winter, and extreme cold is not experienced. Tropical vegetation flourishes. Besides palms and palmettos, there is a variety of vegetation according to location, including cypress, the long-leaved and other pines, sweet gum, bay, holly, ash and wax-myrtle. It is along the rivers and in swampy places that the diversified vegetation and animal life are seen most abundantly. It is no wonder that this summer land, so easily accessible from the North by rail or steamer, is becoming more and more a resort, especially during the late winter and inclement early Spring. Nor is it any wonder that many find permanent homes in a climate so genial and a land so fruitful.

UNIQUE INDUSTRIAL CONDITIONS.

BY W. S.

The report of the United States Steel Corporation recently given to the stockholders is significant in that it is a decided departure from usual business methods. It is not what the popular prejudice against great combinations of capital would lead us to expect. The report in part is as follows:

"The demand for the products of the several companies has been so great, that prices could easily have been advanced. Indeed, higher prices have been voluntarily offered by consumers who were anxious for immediate execution of orders, but the companies have firmly maintained the position of not advancing prices, believing that the existing prices were sufficient to yield a fair return on capital and maintain the properties in satisfactory physical condition, and that the many collateral advantages to be gained in the long run by refusing to advance prices would be of substantial and lasting value, not only to the companies, but also to the general business interests of the country. The strong position thus taken by the companies for stability in prices, both of raw material and finished products, has had a reassuring effect on the trade, and has contributed greatly toward restoring confidence in the general business situation and creating the present large demand for steel products, by dispelling any doubt as to prices in the future."

The far-reaching importance of the policy adopted by this colossal corporation is hard to calculate.

We have always been taught that supply and demand regulated price, but here is a producer entering the field of economics so sure of its position and with such a grip upon the industry that it dares defy this time-honored maxim and voluntarily declares that they will make just so much profit and no more. The result of this action upon their part is to create a feeling of security and stability never before known. Builders can now contract for material to be delivered years in advance, and in these days of great enterprises this means much. It also eliminates from the trade the chance of speculators creating an illegitimate demand for goods which is bound to end in collapse, born of over-production.

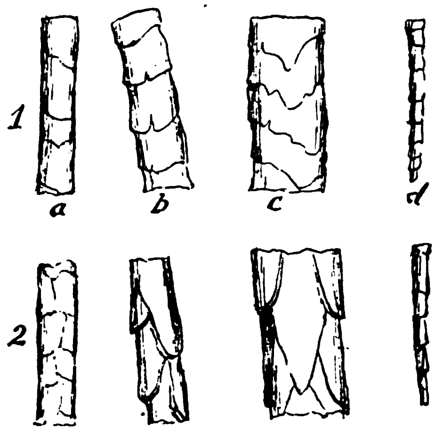
Students of practical economics will watch with great interest the outcome of this far-sighted policy adopted by the United States Steel Co., and it will be an example of a beneficient combination.

Animal Life

FUR FIBRES.

BY HENRY WEBSTER.

The following figures represent some of the fur fibres highly magnified, except the ninth and eleventh, which are hairs of remarkable form. They are mostly portions of drawings, privately printed for friends, by the late accomplished microscopist, Henry L. Brevoort. Of the first four groups, 1–4, each represents but a small portion of the fibre, taken at four points—*a.* at the root, *b.* at the beginning of enlargement, *c.* the central largest part, and *d.* the tip. On this scale of magnification, if the whole fibre had been exhibited, it would have been many feet in length.

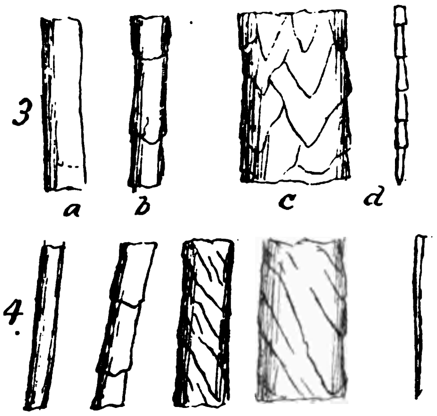


1.—BEAVER. 2.—MINK.

The fibres usually grow in bunches from a single pocket (follicle) in the skin. The most noticeable thing is the smallness at the base and the increasing size near half-way, thence tapering to the end. In the seal fur, however, at several points and even after the diminution begins towards the tip, there are sudden enlargements. The German Hare fibre (4) is remarkably slender at both ends, especially the tip.

The next noteworthy feature is the felt-g scale,—the shingle-like effect—which aries much with the species, in some furs nd hairs thickly projecting (as in the Mink, 2,) in others scarcely visible under lens, as in the human hair, in which its resence is easily proved by the fact that hen a hair is rolled between the fingers will creep in the direction of the root, rom which the scales point towards the ip. In the German Hare (4) and also in the Russian, the scales run spirally. The base of the fibre in some species lacks the scales for some distance, as in 7 and 10. It is termed felting scale because it is the catching on each other of the projecting edges that holds together compactly the beaten fibres. And it is this that causes woolen goods to shrink; swollen by water, he fibres shorten, slip by each other and are held shortened. Hence rapid washng. without change from one temperature when rinsing, is advised. The scales are scientifically described as imbrications of the cuticular layer,—that is, (translated according to derivation) tiles of the little skin, which is the outer skin.

Fur and hair consist of a cuticle, and beneath it a fibrous mass or wall of cortical substance; in the centre a medullary space or pith. This centre is made up of air cells, usually a single row, as in Figs. 5–8. Between these there may be, or may not be, other small cells, and these may, or may not contain pigment. In 5, the White Coney, nothing intervenes between the air cells. In the Gray Coney, the interspaces are filled with dark pigment granules, is in the German Hare (8). In the Russian Hare (7) there are clusters of small intercalary cells but without coloring matter; hence such fibre is white. In the German Hare (8) the air-cells are narrowed and elongated; and in the Nutria (a South-American beaver-like animal), the pigment granules have escaped into the substance of the fibre, the explanation offered being that these granules are water repellent, and thus the water is more effectually repelled when the granules pervade the fur.



3.—AMERICAN RABBIT. 4.—GERMAN HARE.

In animals that are exposed only to dry cold, the pigment is usually absent; and thus there are more air-spaces, which are non conductors that prevent the escape of animal heat. The Sable (10) has a double row of air-cells, The Peccary, as shown by cross-section (9), has oval or flattened hair, the cellular substance projecting like deep fluting into the cortical layer. The bair of a squirrel is filled with cells that contain more or less pigment; that of the musk-deer consists almost entirely of polygonal cells. The most curious hair is that of the Indian Bat (11), of which the scales project in arrow-like points like whorls of the plant called horse tail (Equisetum).

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The Butterflies of Central America.

No less than 1805 species of butterflies are found in Central America and Mexico, as appears from the magnificent 3-vol. quarto work of Messrs. Godman and Salvin. Of these 588 are Nymphalidæ, and 566 Hesperidæ. In North America, north of Mexico, only 645 species are reported.

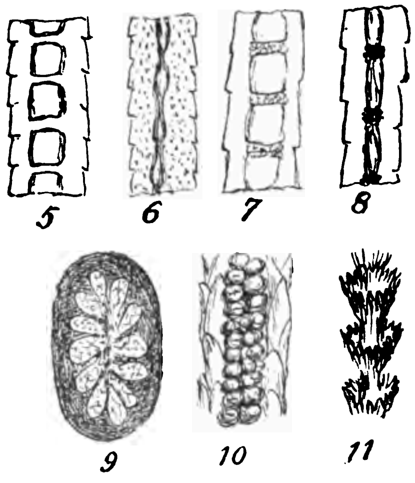
SOME OF THE ORIOLE FAMILY.

BY CAROLINE FRANCES LITTLE.

"Birds, birds! ye are beautiful things,
With your earth-treading feet, and your
cloud-cleaving wings;
Where shall man wander, and where
shall he dwell,
Beautiful birds that ye come not as well."

The family of Orioles, by a strange perversity of American nomenclature, does not contain any Orioles according to the Old World classification; but the name given by those who fancied they resembled the English birds still clings to them, as we always call our Red Breast a robin, though we all know he is a thrush. The Oriole family, called Icteridæ, is an American family, and contains a hundred and fifty species, but there are only seven of them that we are specially familiar with. Some of them are as popular as any of the perching birds that sing.

Who does not love the gay, flirty, little Bobolink (Dolichonyx oryzivorus), as he calls out, according to Mr. Burroughs, "Ha! Ha! Ha! I must have my fun, Miss Silver Thimble, thimble, thimble, thimble, if I break every heart in the meadow!" Who does not lay aside his sorrows while our Robert of Lincoln sings of all the joys that have come to him during his little bird-life? We count him ours, although he is an exile for nine months of the year. He is a member that adds glory to the family, in his stylish suit of black, white and buff. Yet the southern planters tell dire stories of his ravages in the rice-fields, sometimes causing a loss of three million dollars in one year. After his long journey to Brazil, he comes back to us the following May, with so innocent a face that we can hardly believe that he did one naughty thing during his long absence under the name of a Reed bird or an Ortolan.



5–8.—SECTIONS. 9.—PECCARY. 10.—SABLE.
11.—INDIAN BAT.

The shy little Orchard Oriole (Icterus spurius), is not so frequently seen in Northern New England as is his brother. He is valuable to us as an insect eater, destroying rose-bugs, beetles, and worms. He does appreciate strawberries and raspberries, but, if we would plant Mulberry trees in our gardens, birds would leave our domestic fruits in peace. It used to be thought that this Oriole only nested in orchards, but he is found in any tree if the situation be not too public. Of all weaving birds none excel this one in skill. The nest is neatly woven of dried grasses in an even basket pattern, and suspended between branches in an inconspicuous place. He is plain black and chestnut in color, with a stylish cravat, which the younger male does not assume until a year old. His mate is a grayish green on the upper parts, with a brighter color on the tail. Their song is sweet, but most rapidly uttered. The eggs are from three to five in number, blue white sprinkled with black.

Listen to the poet Lowell when he speaks;

"Hush! 'tis he!
My Oriole, my glance of summer fire
Is come at last."

Early in May the Baltimore Oriole (Icterus gabula), proudest of the family, because he received notice from an English Baron, arrives at the North, resplendent in his gorgeous coat of orange and black. It is said that in the first part of the seventeenth century Lord Baltimore (George Calvert) saw and admired this American bird, and adopted his colors. Hence his name.

This Oriole is from seven and a half to eight inches long, larger than the Bobolink and the Orchard Oriole, for they are usually but six and a half. The head, throat, and upper part of his back, also the wings, are black, and these velvet trimmings form a contrast to the brilliant flame color of his attire. His mate is plain, with dull orange about her, but she is very skilful in building her nest, and is a good little mother, with a heart brimming over with love. This bird is known as the Golden Robin, the Hang Nest and the Fire Bird. The nest is like a pocket, five inches deep and three wide. It is usually hung from the extreme end of the limb of a maple, elm or poplar tree.

One day I saw a nest hung in so conspicuous a place that it could be seen at some little distance, like a hammock swinging to and fro in the summer breeze; but being on the extreme end of a branch, no wicked chipmunk would dare venture out so far to rob the nest of its four or six white eggs, with their pretty, irregular spots or lines. It is woven of plant-fibers and strings. Sometimes its builders have purloined skeins of silk for the purpose. A comparison of the nests of different birds even of the same family is an interesting study. How utterly unlike the clumsy nest of the Blackbird is the delicately woven pocket of the Oriole. The work of the latter is almost equal to hand work.

"Mark it well within, without;
No tool had he that wrought; no knife to cut;
No nail to fix; no bodkin to insert;
No glue to join; his little beak was all;
And yet how neatly finished!"

Both Orioles are sweet singers, and thus fully repay us for any domestic fruits they may see fit to patake of.

In the fields where we find the nest of the Bobolink, we may also expect to see the strong-legged, stout little Meadow Starling, Sturnella magna, erroneously called a Meadow Lark. He comes very early in the season, calling "Spring of the year," to let us know that the long cold winter is over, and the sunny days are near at hand. He is from ten to eleven inches in length, and is yellowish-brown in color, with a black crescent on his throat. The pair build the nest in a grassy meadow, arranging it beneath a tuft of timothy to form a canopy over it. The clutch of eggs varies from four to six in number, white with dark reddish-brown spots. They sometimes raise two broods a year.

It really seems cruel to think of the large number of them that are killed annually and served at the table in the form of meat-pies! Speaking of bird-pies, Baring Gould, that voluminous writer, says in "The Mystery of Suffering," "Was the plaintive dove clothed with soft feathers, and given its coral feet, and soothing note, to find a grave in a pie-dish, with its scorched feet thrust through the crust?" Many a person's only associations with our Meadow Lark, the shy tender-hearted songster, is the fact of having seen him served as a delicacy for invalids. Towards Fall he sings less, for the gunners, now that he has grown so plump, are on the lookout for him, and although he is not a game-bird, properly speaking, yet it behooves him to keep out of sight.

The common Blackbird is a member of the family, well known to everyone, and is not wholly a favorite. But I cannot help feeling attached to the Purple Grackle (Quiscalus quiscala). He returns so early in the year to the places he has had to leave during the cold months, and seems to take possession with such an independent air that I can but admire him. I have counted eleven under my window at a time, where I keep a repast spread for the delectation of the birds. He is quite large, measuring from twelve to thirteen inches, and his tailor-made suit of shiny black cloth, and deep sailor collar of greenish blue are certainly suitable for his wedding garb. To most people their note is not pleasing, but it is to me. I look upon it as one part in Nature's grand chorus. Could we hear all at once, his note would blend with the voices of other birds, with the sound of falling waters, and with the sighing of the winds through the tree tops,—all in harmony with the music of the spheres.

"All are but parts of one stupendous
whole,
Whose body Nature is, and God the
soul."

Do we not sing in "The Benedicite," "O all the fowls of the air bless the Lord, praise Him and magnify Him for ever."

The pair build their nest out of sticks and mud, and place it in a tree some fifteen or twenty feet above the ground. They are not supposed to use string, and yet, in my garden, they have worked hard to carry off cord, tied to stakes, which had been used for marking out a flower-bed. The eggs are varied in color, though usually plain blue or green, spotted with brown.

The diet of a Purple Grackle is certainly varied, for though he eats insects and grubs, steals the eggs of other birds, and robs the corn-fields, yet I have seen him overjoyed with a slice of lemon-pie, which he ate with a relish. In September they rove about in flocks, and warn us that winter is coming on apace.

We do not see much of the Rusty Blackbird in Massachusetts, as he nests usually in the northern parts of New England, but the Red Winged species, Agelaius phœniceus, is a summer resident, staying as late as October. He is a part of the returning spring, and it would be incomplete without him. He appears early and builds the nest in damp, moist places, where his home is inaccessible. He likes to nest in colonies, for he is a sociable creature and trusts the birds of his own species. The nest is built between the stems of reed-like plants, and the mother bird lays from four to six blue eggs, spotted with black and lavender.

The head of the house wears a glossy, blue-black suit with scarlet shoulder straps. His mate has no epaulets, but faint orange spots where they should be. Like the other Blackbirds, this one never hops, but walks with a firm tread. His gait may not be actually a strut, like that of his brother Purple Grackle, but he marches about with a pompous air. The Red Winged has a clear, sweet voice, not wholly unlike the Meadow Lark's.

After having mentioned such illustrious members of the Oriole family, it seems dishonorable to reveal their secrets, and expose the fact that there is "a skeleton i the closet," a veritable "poor relatio the Cow Bird (Molothrus ater).

Were one in the country driving some pastures, he would be likely to s walking behind the cows, as they crop t grass, a sleek-looking black bird, with brown head and neck. As the cows on, the insects fly up to escape injury. the little feathered creature follows b hind, to feed upon the bugs. At first sig one would suppose that this was an u right bird, worthy of emulation. B alas, no! The Cow Bird is a tramp, a di grace, not only to the Oriole family, but the Bird Kingdom. Lazy, shiftless a intrusive, he is a socialist of the mo rabid kind. When all members of th Bird family are building their nests a preparing to rear their families, he a his kind talk over their socialistic ide and decide, because he has no nest, a is too lazy to build one, that his mate h a right to make use of the home of so bird who has toiled early and late to build the home-nest. What seems particularly detestable is that the lady Cow Bird usually chooses the nest of some one who is so small that she and her mate cannot push out the intruder's egg. Often she selects the nest of a Song Sparrow, or that of the Yellow Warbler; but the latter bird will not consent to assist in the support of a vagabond, and builds either another nest over it, or abandons the old site. If the egg remains and is hatched out, the little mother-bird has no easy time in feeding her adopted child, for its appetite is voracious. When able to care for itself it seeks its own kind, and becomes another outlaw in the Bird Kingdom.

When the leaves begin to turn, and the trees stand before us in their brave attire of red and yellow, then the Oriole family wing their way to sunnier climes, for the New England winters are too severe for them to encounter. The Bobolink is the first to go, lured by sweet dreams of the rice fields; then later in September the Baltimore, still in his gay attire, for he is one of the few birds who retain their courting suit all the year round, follows in the wake of his brother. Now the Grackles and Red Wings gather in flocks and discuss the plausibility of a journey. The faithful Meadow Lark stays late, in fact in some localities all winter, but, like friends in adversity, the majority of them forsake us, as a poet says:

"Gay birds, ye visit us when bright
The summer sun in glory shines;
But from our fields you take your flight,
When autumn day by day delines."

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FUN WITH KILLIES.

BY AGNES VINTON LUTHER.

For a combination of all the virtues and vices of the fish-world the killie is without a rival. After a few months of companionship with these erratic little individuals, the ordinary placid gold-fish retires into the background as an aquarium pet.

Armed with a pail and a fish-net with fine meshes, stroll along any of the shores near New York, and you will be able to take home all the captives you wish. Where a stream runs into the sea, one can sometimes capture nearly all of a miniature school, intent on a trip up into the country when the tide sets up these small streams. The variety of killie most commonly found in these waters is the Fundulus heteroclitus. It is the green killifish (*Kil*, Dutch for creek or channel,) known also as mummychog or salt-water minnow.

They are a salt-water fish, that is, they live in the sea, without a doubt. However, on one occasion when a too grasping student insisted on bringing home four times as many fish as could live in the salt water she had collected, I insisted upon a slaughter of the many for the sake of the few. When it came to selecting the victims and deliberately taking them out, and laying them on the marble table which was to serve as a morgue, I hesitated and thought of a possible compromise. Having informed the killies that their lives hung by a thread, and that as salt-water fish they had no business to live in anything else, I dumped them into a jar of fresh water and lo! they forgot their salty nature and became fresh water fish, which they are to all intents and purposes, to this day. When I have an extra supply of salt water, I turn them back into their marine quarters, and if that water is needed for any other specimens, I return them again to their fresh water jars. It is all one to them. Imagine a brook trout submitting to such treatment.

CATCHING KILLIFISH WITH HAND-NET.

Time never hangs heavy on the hands of a killie. He is constantly in action. When the curtain cord bobs up and down outside his jar, he bumps his nose joyously against the glass, over and over again in a vain attempt to reach it. A drop of water trickling down the outside must be chased the entire length. When other things fail, he chases his companions from place to place.

Supreme enjoyment of all, though, is meal time. For disinterested devotion to duty, the killie may be given the palm. He eats, not to live, nor apparently because he is hungry, but to eat. He begins on a meal of bits of oyster thrown to him, and eats and eats and eats. Hunger long since satisfied, he still eats. Capacity long since exhausted, he still eats. There would seem to be naturally a limit to what the fish can hold, but to overcome this, when the killie has reached this stage, as soon as he eats a piece he ejects it from his mouth to make room for the next, which he seizes with undimmed ardor. Meals served at the end of a hat-pin result in his attempting to swallow the hat-pin in his anxiety to do justice to the piece of oyster impaled thereon.

The senses of this fish are extremely acute, and a piece of food dropped quietly on the water at the top of the jar is almost immediately perceived in whatever part of the jar the fish may be, and he instantly shows a perturbation of spirit indicated by sudden darts here and there to discover whence the taste or odor proceeds. Killies can be tamed within a few days and soon learn to crowd around the finger holding the food, giving the softest little bites even after all is gone, to be sure that nothing good to eat remains.

Their restless activity is in strong contrast to their neighbor in the next aquarium to them, a Japanese gold fish, in whom generations of Fan-tails have bred an ease of manner and a graceful motion, as he glides from place to place, disdaining hurry, that the killies would do well to imitate. However, this intense activity and energetic mental make-up wins many a lover away from the gold fish. The killies' eager response to every attention makes them pets indeed. Try it and see.

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Spider Silk.

It is said by Invention that a syndicate has been formed for the purpose of introducing spider silk as a commercial commodity. It is stated that no difficulty has been experienced in acclimatizing the most prolific species of African and Brazilian spiders, some of which weave webs from 8 feet to 12 feet in diameter, and quite as strong as the ordinary silk of commerce. The most valuable web is that spun by an African spider. The thread is yellow in color, and so like the product of the silkworm that it can scarcely be distinguished from it. Gloves woven from the silk command exorbitant prices, as much as £20 being paid for a single pair. They are like the historical silk stockings.

THE AMERICAN SEAL FISHERIES.

BY H. A. CRAFTS.

With the purchase of Alaska from Russia the United States became possessed of the greatest seal fisheries in the world. They were great fisheries in point of animal life, but from a territorial point of view they were indeed insignificant. The grounds are composed of the Pribilof islands, which lie in Behring Sea, about two hundred miles north of the Aleutian archipelago. The two principal islands are St. Paul and St. George. Of these two, St. Paul is the most important, being thirteen miles in length and ten miles in width. St. George is eleven miles in length and seven miles in width.

Besides these there are three smaller islands known as Otter, Walrus islands and Sea Lion Rock. These islands are all of volcanic origin and are composed entirely of larva and cinders. In the center of St. Paul island is the volcanic crater, Bogoslof, which rises to a height of six hundred feet. St. George is more elevated than St. Paul, its central peak, Aluekeyak, being 930 feet in height. The surface of the elevated parts of the islands is, during the summer time, covered with moss and grasses, interspersed with a profusion of wild flowers. Among the latter are found the Iceland poppy, monkshood, lupine, betony, chrysanthemums, senecio, saxifrage, harebell, etc. The lower parts of the islands are covered with a soil of black lava sand, where grow rank wild grasses.

As to climate, the Pribilof islands are almost constantly enveloped in mist. During June and July the weather is continuously cloudy, and subject to fogs and drizzling rains, with prevailing southeast winds. In August the weather is clearer, but the storms become more violent, so that by the middle of September all vessels that can get away, leave Behring sea. Winter brings more clear days which are interspersed with tempestuous storms. The ice floe gathers around the islands, filling all the bights and inlets, and the snow accumulates deeply in the hollows on the islands. In April and May the ice floe disappears, but some of the snow banks lie on until late in the summer.

It is upon these relatively unimportant islands that the great American seal herd finds, during the breeding season, an abiding place. Wherever there is to be found a rocky beach or a sloping, rocky hillside, the seals form their rookeries. Upon these rookeries the seals at times crowd so densely that many of the young are trampled to death. Although the American herd has been terribly decimated by pelagic, or open sea sealing, during the least decade, the total number of seals on the islands in October, 1896, when a census was taken, was placed as high as 392,523; and at the same time it was estimated that the number of deaths among the seals from all causes for that year amounted to 86,624.

The size of the Pribilof seal herd, according to the statements of the Aleuts, reached its lowest point some fifty years ago, at the time of the great ice jam, in which many thousands of seals were drowned while endeavoring to climb the inaccessible icebergs and floes. When the herd passed from Russian to American control, in 1868, it was in good condition, and was increasing rapidly. Many male seals were slaughtered, but the females were saved. Until 1872 the herd continued to increase. From 1872 until 1878 the herd merely held its own. Then the northwest catch increased from 5,000 per year up to 16,000 per year in 1883, when the pelagic sealers for the first time entered Behring sea. In 1886 the northwest catch fell from 21,000 to 13,000, but the Behring sea catch increased to 14,000. Since that time there has been a steady and rapid decline in the herd.

In 1896 there were twenty-one American vessels engaged in pelagic sealing, whose total catch amounted to 11,560 seals, of which 3,437 were taken from the northwest coast and 3,121 from Behring sea, the balance being taken from the Japan and Russian coasts. During the same year there were sixty-eight Canadian vessels engaged in pelagic sealing, and their total catch amounted to 56,380 seals, of which 10,800 were taken from the northwest coast and 26,277 from Behring sea. In 1893 the *modus vivendi* between the United States and Great Britain went into effect, and by its provisions the Behring sea was closed to the sealing fleet from the first of August until the first of October. By this arrangement, and various other methods employed to conserve the integrity of the herd, the decline was, in a measure, checked.

But to show how legitimate sealing has fallen off, a reference to the statistics for the past thirty years is only necessary. For a period of twenty years, extending from 1869 to 1889, the seal fisheries of the Pribilof islands were leased from the United States government by the Alaska Commercial Company, which, during that period, killed on St. Paul island, 1,800,000 seals, and on St. George island 300,000, making a total of 2,100,000 seals, or more than 100,000 seals annually. Since 1889 the fisheries have been leased by the North American Commercial Company, of San Francisco. In 1897 this company killed on the Pribilof islands 30,000 seals; last year it killed only 15,000, and this year, according to the report of Major E. W. Clark, special agent of the U. S. Treasury Department, in charge of the seal islands, the seal crop will amount to only about 10,000 head, or about one-tenth of what it was ten years ago.

The question then naturally arises: How long will the seal herd last at this enormous ratio of decline? Pelagic sealing continues unabated and principally by Canadian vessels. It was hoped that the controversy between the United States and Great Britain, as to the right of the subjects of the latter nation to catch seals in the open seas, would have been settled ere this by the joint high commission which has been sitting in Canada since some time last winter, but the hopes thus entertained have not yet been realized. It is maintained by our government that these seals are the property of the United States, no matter where they may be found; whether upon their natural breeding grounds upon the Pribilof islands; in the open Behring sea or in the north Pacific Ocean while on their southern migrations southward during the winter months, and they are legally inviolate from the incursions of pelagic sealers.

But beyond the shore limits and outside of the Behring sea close season, the pelagic sealers do not recognize this principle. They steal up to the seals as they lie asleep upon the surface of the sea, and slaughter them with spear, club or firearms. It is estimated by those who have made an exhaustive investigation of the subject, that since pelagic sealing was first practiced, not less than 600,000 fur seals have been taken in the Behring sea and north Pacific by pelagic sealers; including 400,000 breeding females. This means also the destruction of at least 700,000 young seals, born and unborn. And as the slaughter goes on with almost equal rapidity in both Russian and Japanese waters, the final doom of the species can easily be foreseen.

For in all the world there are but three herds of fur seals—the American, the Russian and the Japanese. The Russian herd occupies the Kormandorski islands or Commander islands and Copper islands. The third herd occupies the Okhotsk sea, being resident upon Robben island. In 1898 Russia and Japan together caught only 30,000 seals; less than one-third of what the annual catch of the United States alone was ten years ago. With the same ratio of decrease in this that has been observed in the American catch, the entire product of the world for 1899 would amount to only about 30,000 seals. To the United States this destruction of seal life not only means the extinction of the most valuable fur-bearing animal known, but the loss of a large amount of revenue to the treasury, as under the existing contracts the government receives for each seal killed on the Pribilof islands something like $10.

For a period of ten years up to the 4th of October, 1898, the Hon. Joe Murray acted as Special agent of the U. S. treasury department in charge of the seal islands. He died on the date named of paralysis at his home in Fort Collins, Colorado, while on his way to Washington to make his report to the government. So faithful had been his services, and so zealous had been his efforts to protect the seals from the depredations of the pelogic sealers, that he had been retained in office through several changing administrations.

He inaugurated a system of branding all young female seals found upon the islands in order to destroy the commercial value of their skins and that their lives might be spared by the sealers and the animals preserved for breeding purposes. Then he had a way of herding the young bachelor seals within woven wire fences erected upon the islands, thus preventing them from putting out to sea and falling into the hands of the sealers

These expedients coupled by the closing of Behring Sea for a couple of months during the breeding season, had the effect to check the slaughter of the seals in open sea, but so persistent are the sealers that the herd is surely doomed unless some agreement is very speedily arrived at between our government and that of Great Britain whereby an end will be put to pelagic sealing; making the life of the seal as sacred anywhere in the open sea as it is upon the seal islands themselves.

The fur seal or "sea bear," known scientifically as Callorhinus ursinus is only resident on the islands of the Behring and Okhotsk seas already mentioned, which were unknown to aboriginal man, and none of them having been visited by man until about 1741. The male fur seal reaches full maturity at an age of about seven years and weighs when full grown from 400 to 500 pounds. The males vary considerably in color, but the prevailing shade is black or dark brown, with longer hairs or bristles of a yellowish white. The female seal is much smaller than the male, with soft, smooth fur, of varing shades of brown. The average weight of the female seal is about 80 pounds. The food of the fur seal consists mainly of fishes and squid whose habits require them to swim upon the surface of the water.

Cement for Porcelain.

An almost invisible joint may be made, with careful handling, with the following:

Chloroform	60 parts.
India rubber	25 parts.
Mastic	15 parts.

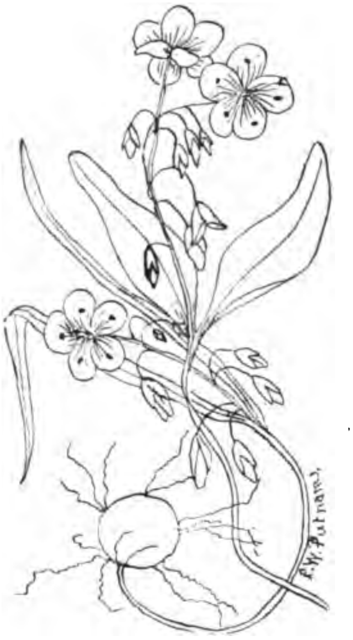
Cut the rubber into shreds, put into a suitable vial, and pour on the chloroform. Stopper tightly, and set aside until the rubber is dissolved, then add the mastic, and let stand until the same is dissolved. Apply the cement to each surface to be united, and let the pieces stand until the greater part of the chloroform is evaporated, then unite, press firmly to place, and if possible, tie in position. When the cement is apparently thoroughly dry on the surface, scrape off the superfluity, and dust over the line of junction a little zinc oxide, chalk, powdered infusorial earth, or some such material, and with a clean pencil brush it over the joint. After the cement has become perfectly dry, remove the cords and rub off the superfluous powder. The joint can scarcely be discovered if the work has been well done, and a little practice will make the operation perfect.—Phar. Rund.

Plant Life

THE SPRING BEAUTY.

BY BESSIE L. PUTNAM.

This flower seems especially made for the young botanist, its simple form offering an admirable subject for applying the principles of plant life conned from books during the earlier weeks of spring. Thus it was that Dr. Asa Gray, who picked up the study during the winter months, without teacher or laboratory facilities,—without even so much as a greenhouse or potted plant for observation, says: "I sallied forth one April day into the bare woods, found an early specimen of a plant in flower, peeping through dead leaves, brought it home, and with Eaton's 'Manual,' without much difficulty, I ran it down to its name, Claytonia virginica. (It was really C. caroliniana, but the two were not distinguished in that book.") He was so well pleased that he went on, collecting and examining all the flowers he could find, and eventually laying the foundation of a study which deems the mere name of a plant of much less importance than its life-history.



THE SPRING BEAUTY.

The brown tuberous root, slightly compressed from a true spherical form, is so deeply buried in the soil that we are prone to think this a device of nature to protect it from the ravages of native rodents who might find therein a savory morsel. Almost as quick as the snow melts, one may find the fleshy leaves peeping up, preferably along the sunny slopes of wooded streams. The flowers appear in loose terminal racemes, each floret being protected by two brownish sepals which persist in fruit. The five petals are shell-tinted or almost white, daintily marked with carmine veins which radiate from a common center, and doubtless serve as "honey guides" to the numerous bees and flies which rush to greet the frail looking harbinger of the floral procession. The blossoms last several days, opening, like those of a near relative, the portulacca, only in sunshine. The stamens are surmounted by anthers of exactly the same hue as the pencilings on the petals.

It is a recognized principle that for the highest welfare of plant life individuals must be fertilized with pollen from a neighboring plant; cross-fertilization, this is called. The spring beauty, bearing both stamens and pistil on the same plant, uses a plan quite common to secure this: The stamens mature before the pistil is ready to receive the pollen. As the flowers first open, the pollen is discharged from the anthers and the latter drop back against the petals. The three-parted stigma, however, remains closed; and when it opens the pollen is forever gone. But a downy bee, intent on gathering nectar or pollen, hovers over the flower long enough to brush upon the pistil some of the pollen which clung to his velvet coat when visiting the last newly-opened flower. Thus the bees effect cross-pollination while pursuing their own private work. Ants, having smooth bodies, are not effective pollen-carriers, and many are the schemes of nature to prevent them from carrying away the sweets which they do not earn. The slender stems of the spring beauty render it not easy for them to mount.

Two species, C. virginica and C. caroliniana, both perennials, are common in many parts of the east, extending southward to the Carolinas and westward, the latter being found as far west as the Rockies; while a closely allied species, with short stem leaves, C. lanceolata, continues to the coast. There are also some annual and at least one Alpine species found in the extreme west.

While our two eastern species are so nearly alike as to be regarded among nonbotanists as identical, there are some distinguishing marks which render them easily identified. The principal of these is, the foliage of C. virginica is long and grass-like; that of C. caroliniana is much broader, ovate or almost spatulate. The latter, too, generally produces slightly larger flowers, though in smaller clusters. All in all, it is not surprising that young Gray, with only the one species described to him, should fall into the error confessed.

After fruit is perfected the leaves die to the ground, and during the summer and autumn there are no visible signs of life, though the subterranean work of storing up strength for a strong vernal push quietly proceeds. In woods this plant is a frequent companion to the yellow adder's tongue, Erythronium americanum, and the earliest of cresses, Cardamine rhomboidea, var. purpurea, though the first of the trio to bloom. As before mentioned, its earliest haunts are along the southern slopes of small streams. Later, it is often found along moist roadsides, and the writer has frequently seen whole fence corners completely covered with it, evidently in its greatest luxuriance, but always of a paler hue than when in partly shaded situations.

Though so frail and delicate in appearance, it is happily not a plant to pine and die because of changed conditions. The farmer may destroy all shade and plow his ground, but the little Claytonia will still cling with loving grasp to the narrow strip of virgin soil bordering his fields.

It bears transplanting well, even when in flower. A preferably shaded position being chosen, it may be confidently expected to blossom freely each year, increasing both from root growth and seedlings. It will even thrive among the grass, dying down before the lawn mower is called into service.

In short, it seems highly favored among our beautiful American plants, fragrance being the only essential lacking. With the modesty of the violet, it still possesses strength to hold its own amidst a series of adverse conditions. Poets have sung the praises of the Mayflower, but for those who have gathered these little striped beauties weeks before the buds of the more hardy-looking vine had commenced to swell, no words are needed. The floral trophies speak adequately.

THE MOTH MULLEIN.

BY GRACE CAMPBELL MOORE.

When you are looking about the meadows and lawns during the month of August, you will be likely to come across some little, fattened purple and white packets. They are very tiny, but I am sure you will notice them because of their angular, flattened shape. Mysterious little parcels they are! Long before I knew them by name, I longed to peep at their contents. But this one must never do. It would be a case of ‘lese majestie.’ These are royal parcels; their very color denotes it. A gay little mikado from the Flowery Kingdom has sent on his luggage before him. This is one of his relay stations, and you must not disturb the silk wrappings of his baggage.

If you will patiently wait until nightfall, you shall witness a bit of Oriental witchery. At an appointed hour—some little time before the royal traveler arrives, perhaps—these tiny valises will open, without the help of hands, and quite by magic. (You will have noticed beforehand how the broad upper lid was loosening.) Forth from our package will be unfurled a fair white pavilion, four-lobed and tinged with purple; and this will serve as a signal. In the pavilion a nectar-sweet feast is spread, whose refreshing fragrance will reach the laggard long before he views it. But his couch is of all things the choicest! Emerald is its frame, surmounted with gold, and the cushions are of softest, fluffiest, silkiest purple fringe. How can he delay when so much beauty, daintiness and comfort await him?

We are told of silk so cobweb-fine that thousands of yards of it may be pressed together and passed through a finger-ring, but the wonder of it as nothing compared with the wonder of our royal packet. Who was the conjurer who skillfully folded away so many things in so small a compass, with never a burst or a bulge in the wrappings? Who is he that claims such luxurious splendors? Ah, the secret is mother nature's; but she will yield it to you, if only you will visit your moth-mullein plant, Verbascum blattania, by daylight and by starlight; and, if you will, you may look on while our moth mikado nestles in the heart of his pavilion and sups ambrosia like a very god.

The above fanciful sketch of the moth-mullein resulted from the finding of stalks of the exquisite white variety of the plant, on a city lawn. The moth-mullein usually bears yellow petaled blossoms; but these petals were white, tinged with purple, especially upon the superior lobes of the inferior surface of the monadelphous corolla

The stamens are five in number; the superior stamens being the shortest, and the other two in pairs, of which the inferior pair is the shorter. The pistil is long, and projects from the midst of the stamens in such a way as to prevent self-fertilization. These stamens are very beautiful; the filaments are purplish and fringed with purple hairs; the anthers are green, edged with yellow and covered with yellow pollen.

Neltje Blanchan, in Nature's Garden, says that these fringed filaments are to furnish a foothold for insects. As moths rarely alight, Blanchan thinks these footholds must be for day insects (bees, flies and the like), and considers the name "moth" mullein most unfitting. Except on a very cloudy day or on a chilly day late in the season, when a stray plant had possessed sufficient hardihood to outlive its generation, I have never succeeded in finding the blossoms open during the hours of sunlight.

It may be that, before closing, they are accessible to day insects in the earliest hours of the morning; but my experience with stalks of buds in water, under varying conditions of light and air, leads me to assert that they never open before eight o'clock in the evening, and usually much later. I do not find fault with the name moth-mullein, for the blossoms open at the close of one day and fade soon after the dawn of the following one. On a cool day, the blossoms will keep open in any shaded room in the house for twenty-four hours, and, during excessively warm weather, they have been kept four nights and three days in a cool, shaded cellar.

In Ashantee grows a tree resembling the English oak, which furnishes excellent butter.

Plants Hot-Watered.

Not by any means a new practice, the use of hot water in watering plants growing in pots is one of the neglected or almost forgotten facts of the old-time gardening. We do occasionally find it recommended to use hot water as an insecticide, but it is with a somewhat different object in view that reference is now made to the point. In 1855, nearly half a century ago, a writer in the German publication, Gartenflora, drew attention to the successful results that followed from the use of hot water on plants in pots when they had come into what is commonly called a soured condition. It is there stated that a certain Mr. Lucas had for some years past had recourse to a very simple method of revivifying the soil in pots which had become stagnant or soured. Instead of following what might be termed a regularly orthodox practice, he watered with hot water, and, it is remarked, that the practice was always successful, enumerating as the subjects tried Palms, Roses, fruit trees in pots and Rubber Plants, Ficus elastica. A specific report is given of an experiment with the last named which had been growing in a dwelling house in glazed pots.

The plants, at one time vigorous, had sickened and developed certain signs of approaching death. The young leaves were limp and the others were spotted with numerous black areas. The surface of the soil was scarified and then copiously watered with water at the high temperature of 144 deg. F. The water was applied until it ran out in abundance from the hole at the bottom of the pot. The water which first came through was perfectly clear, but later it was appreciably colored brown, and we learn that at that time had a distinctly acid reaction. After this washing or irrigation the plants were placed into a warmer situation and the following day the young leaves had picked up, the ugly spots ceased to grow and three days later the two rubber plants were restored to their pristine health. The soil itself was "live" and after drying out had all the appearance of fresh compost. The plants continued in, and never stopped vigorous growth and soon threw out a number of new roots.

So much, then, for the ancient records, but we are glad to learn that Mr. Jules Burvenich, a well-known Belgian horticulturist, has lately been interesting himself in a duplication of these experiments and reports himself as thoroughly satisfied with the results. He used water of a temperature of about 125-130 deg. F., having for his subjects a diversity of plants, such as Clivia, several Palms, Ficus, Begonia, Aspidistra, Primula and Dracæna. "We do not know how we can sufficiently recommend this practice, either as a curative or a preventive method," is his summarized comment.

Especially to amateurs and those having plants in dwelling rooms will this method of treatment appeal and it would be, perhaps, an excellent thing to give the treatment in winter time. It is a matter of common knowledge that soil inclosed in a pot in which a plant is growing ultimately becomes sour and has indeed a certain poisonous quality. This toxicity is due to the presence of organic acids in excess and which in the ordinary open ground conditions would have been removed by bottom drainage. Plants growing in pots are under distinctly artificial conditions and there are many causes which lead to the accumulation of these toxic acids. For instance, too deep planting, or when the roots are not sufficiently aerated; the use of over-hard baked pots or glazed receptacles; the compacting of the soil and particularly the absence of or clogging of the drainage. Naturally this accumulation results in the burning of the young root tips. Activity is reduced and the whole system of the plant suffers from the shock.

A final word of suggestion may be acceptable. Supposing the plant should have been thus treated to the hot water bath it would be well to supplement the possible loss of food elements by a slight application of a chemical fertilizer; nitrate of soda in mild doses may be used for all foliage plants in pots. In the case of fruit and flowering plants, some other adjuncts might be desirable according to circumstances. Some plants are much less able to accept chemical food than others; generally speaking, palms and ferns require careful handling, but the rules of gardening practice will govern the operator.

It is reasonable to believe that if the hot water will dissolve and wash out the poisonous acids it would also dissolve and carry off all essential elements of plant food. Therefore they must be supplied artificially.

The ordinary way of recovering a plant in the condition described would be to repot into fresh compost, using a clean or new pot, always taking care to insure good drainage and plunging the pot into a slight heat for some weeks. And it is found a satisfactory method. How much easier, under certain conditions, would be the hot water treatment.—Amer. Gard.

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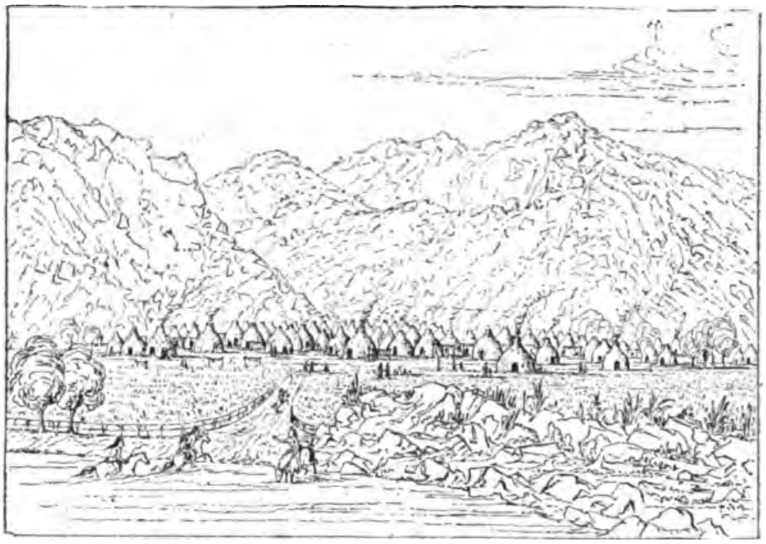
Sunflower-Seed Oil.

Consul Ravndal reports from Beirut that olive oil has many uses, but more substitutes. Few salads are compounded without the aid of one of them. Cotton-seed oil is a favorite substitute, but, according to an Egyptian newspaper, this is soon to find a sturdy rival in the form of the seed of the sunflower. Experiments made by German chemists have convinced them, it seems, of the availability of this cheap raw material, and it may shortly become a valuable article of commerce. It is said to be convertible to many uses, and, besides having possibilities as a lamp oil, may be used for dyeing purposes, and in soap making.—Sc. Am.pd

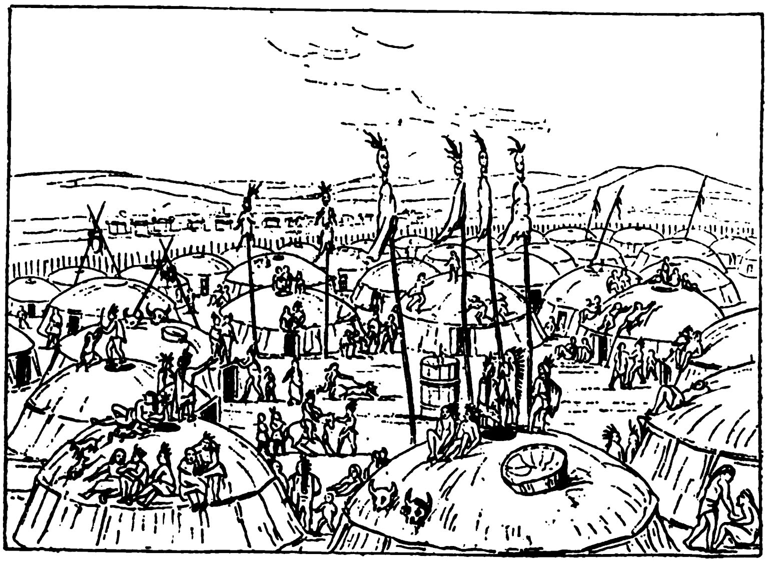
Archaeology

Architecture of Indian Tribes.

In the February number of the American Antiquarian, the editor, Stephen D. Peet, has an illustrated article on this subject, from which we extract. Here he would call attention to the contrast between the architecture of the southern tribes and that of the northern tribes. These tribes have been considered as belonging to the same race and as occupying the same social status, manifesting the same stage of progress, but when we study their architecture we find a great contrast, for it resembles that of the civilized tribes of the southwest far more than that of the uncivilized tribes of the northeast, showing that it had been borrowed from or had been influenced by the people of the southwest, and had perpetuated that influence for many generations.



HOUSES OF THE COMANCHES.



HOUSES OF THE MANDANS.

He says: The following were the methods of constructing and ornamenting houses among the northern tribes:

The Dakotas constructed theirs in the form of conical tents, out of poles, covered them with buffalo skins, and ornamented the sides with the clan-totems or with the dream-gods or some other figures suggestive of their mythology.

The Comanches constructed theirs out of poles, but thatched the outside with reeds and grass, in such a shape that they resembled so many stacks of hay.

The Mandans constructed theirs out of heavy posts with cross timbers, and covered the whole with sod and placed their totem poles in front of the houses.

The Ojibwas constructed theirs out of poles and bark but in an oblong shape, with the ends upright and a door at each end. The Iroquois built theirs also with a frame work of poles and a covering of bark in an oblong shape, but with a long passageway running lengthwise of the hut, and places for different fires in the passageway. The interior was divided into apartments for the different families.

The Powhattans built theirs in about the same way as the Iroquois, but the Seminoles constructed theirs of posts which were set upright in the ground and placed in a circular shape, with a conical roof made out of rafters which were thatched with reeds and grasses.

These northern tribes made no distinction between the houses of the chiefs and those of the common people, for they were all of the same style and appearance, and were on a common level and were generally placed in a circle about an open area, sometimes with a stockade around them to protect the village. The only structures which were separate from the villages were the lookouts on the hill or the burial places near by.

When, however, we come to the southern Indians of the Muskogee stock, such as the Creeks, Cherokees, Choctaws and Chicasaws, we find an entirely different system. These tribes dwelt in villages, but they were villages which resembled in a rude way the cities which were occupied by the Aztecs, Toltecs and various tribes of Central America. Among the points of resemblance, the most important one is, that the ruling classes and officials, such as the chiefs and their families, lived separate from the common people and built their houses on the summits of pyramids. The priests, or medicine men, also had their temples or rotundas upon the summit of conical mounds.

The Age of Stonehenge.

Diodorus of Sicily reported in the fourth century B. C. that there was an island in the north containing a temple dedicated to the sun, and Julius Cæsar bears witness to the astronomical learning of the Druids. Stonehenge is accepted as a solar temple by most archæologists, and Sir Norman Lockyer has calculated its age on the hypothesis that it was built so that the priest at the altar would just perceive the solar rays at the summer solstice. Granting his hypothesis, it appears that the date was about 1,680 years before the Christian era —some 36 centuries ago.

A striking discovery has been made during excavations which were necessary to raise one of the monoliths in the famous prehistoric group at Stonehenge, in Wiltshire, into an upright position, says the New York Sun. The men engaged in the work have found numerous neolithic implements, which had evidently been used in cutting and squaring the stones, and, when blunted, had been turned into the bedding on which the stones are supported. Although so many relics have been unearthed of late that it is apt to lead to contradictory conclusions, the discovery is held to prove that the unique monument of Stonehenge is anterior to the Bronze age, and that the structure still visible was certainly built before 1500 B. C.

INDIAN RELICS IN NEBRASKA.

BY REV. R. J. CROSS.

In York county, Nebraska, there are several low places called "basins." In very wet seasons they contain standing water. An interesting fact connected with them is that, directly south or southeast of them, the land is higher than the surrounding prairie, making a sort of low mound or hill. On a level prairie such a rise in the ground is quite noticeable and can be seen a long way off. It looks as though a strong northwest wind, or long series of such winds, had scooped out the low places and deposited the dirt on the southeast side.

One such basin, about seven miles southeast of York, the county seat, is about a mile in diameter. Old settlers say they have seen it entirely covered with water. On the gentle slope of the higher ground, south of it, is a cornfield. The soil is entirely free of stones and boulders, as the limit of the old glacial area runs many miles east of that locality. Last spring they ploughed the ground deeper than usual, and in two places, about a rod apart, turned up bunches of Indian flints.

Probably the Indians were camping on the shore of the temporary lake for the purpose of hunting wild fowl. But who can tell how long ago they were there and were driven away by some sudden alarm or attack? We simply know that the manufacturers of Indian implements—perhaps two of them—buried a part or all of their material a foot or more in the ground and never came back for it. The whole find, except a very few pieces, was given to the writer by the owner of the land, Judge Wildman. There are 197 pieces, ranging from small flakes to some that weigh four ounces. They are in all degrees of preparation. Only a few approach completion as arrow heads or spear points. Some have edges that fit them to be used as knives or scrapers. Some of them resemble the Indian implements figured in the January number of POPULAR SCIENCE NEWS.

Probably the Indians, when they left that camp, took away with them all the perfect implements, while what they buried consisted for the most part of partly finished pieces, some that had been spoiled, and some that might possibly be used for some purpose or other. The material is interesting on that account. It lets us into the workshop of an Indian implement-maker. Often he must have handled these flints and debated with himself or with others as to what could be made out of them.

The material is a gray chert, somewhat different from the material of similar finds in other parts of Nebraska. It is the first collection of such stones found in York county.

This is a fertile hunting ground for relic hunters, and some interesting finds may be expected.

The Cave of Zeus.

In the ancient Greek mythology the god Zeus was the son of Kronos, king of heaven, and was born in a cave on a high hill on the island of Crete. Because of a prophecy that the child should cast him from his throne, Kronos sought to kill his son, and it was because of this that the mother Rhea fled to Greece and there reared the child, before whom Kronos was forced to bow. The cave came to be regarded as a holy place by the Greeks. Minos the law-giver of Greece, was the son of Zeus, and every nine years he repaired to the cave, there to receive the inspired laws for the guidance of the land. The recent discoveries would seem to prove that the legendary Zeus and Minos of the ancients rested on a basis of reality and that there was a history side to them.

For many years Greek officials and wild hillmen, intolerant of strangers, have prevented any exploration of the inner part of Crete, and it is only recenty, therefore, that there has been any archæological research there. Reports reached the outer world that shepherds, tending their flocks in the vicinity of the rocky hill known as Dicta, had found strange objects of bronze and other metals near the mouth of a cavern. Some of these objects found their way in time to the hands of archæologists, and so manifestly were they votive offerings of very ancient design that they indicated plainly a locality rich in interest. When Crete was liberated the interior of the island was open to visitors, and the British government, securing a concession to explore this cave, put Mr. Hogarth in charge of the operations. At the opening of the year he established a camp of Cretan workmen at the foot of the hill and began the work. Soon, a zigzag mule-track was made up the 500-foot slope of rock which led to the entrance of the cave. It took four days to blast away the immense bowlders that blocked the entrance to the cave, exposing the black mouth of the great orifice, which Mr. Hogarth describes as follows:

"The great cave is double. There is a shallow hall to the right and an abysmal chasm to the left, the last not unworthy of a place among the famous limestone grottoes of the world. The rock at first breaks down sheer, but, as the light grows dim, takes an outward slope and so falls steeply for 200 feet into an inky darkness. An icy pool spreads from your feet about the bases of fantastic stalactite columns, on into the heart of the hill. Hall opens from hall, with fretted roofs and black, unruffled floors. Fit scene enough for Minos' mysterious colloquy with his father, Zeus."

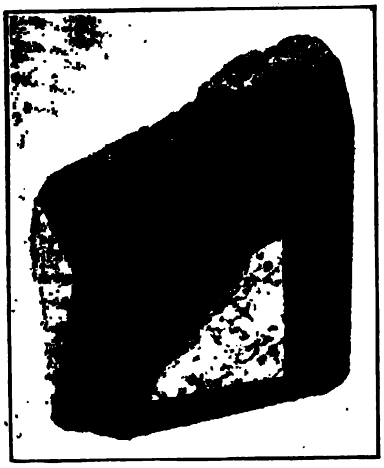
Pueblo Ruins in Kansas.

The existence of Pueblo ruins have been known to the people of the vicinity. They are situated in the Northern part of Scott county in the valley of a creek which flows into the Smoky Hill River.

Minerals

[Edited by A. C. BATES].

Titanite is a titano-silicate of calcium. Crystals monoclinic and hardness 5—5.5 brown to black, opaque to translucent. There are several varieties, the chief one, sphene, is yellow-greenish and often translucent to transparent. Some years ago (1891) there were found at the Tilly Foster iron mines near Brewster, N. Y., a number of transparent crystals of honey yellow sphene from which gems of great brilliancy were cut and for which fancy prices were obtained. One fine cut gem of 10 carats is in the National Museum at Washington. Previous to this find the best crystals of sphene came from Tavetsch, Switzerland, a locality famous for its many beautiful mineral products.



TITANITE, LITCHFIELD TOWNSHIP, PONTIAC COUNTY, QUEBEC, CANADA.

Titanite occurs in imbedded crystals in granite, gneiss, mica and chlorite schists, and in granular limestone in beds of iron ore and igneous rocks. There are a good many European and American localities, but the titanites of Canada are the best known as they have a world-wide reputation for color, lustre and perfection of crystalline form, and also for their great size.

A twin crystal of titanite was found at Sebastopol, Ontario, which weighed 80 pounds. The crystals of Renfrew County are usually dark brown or black in color, and none show any transparency. Those from near Egansville were found associated with many other fine minerals such as doubly terminated crystals of scapolite, phlogopite, zircons, some of them twinned, and apatite.

A new locality for titanite is Litchfield township, Pontiac county, Quebec, about 30 miles distant from Egansville, from which some splendid lustrous black crystals were recently taken, associated with groups of white scopolite crystals and molybdenite.

The metal titanium has many properties. It gives hardness and toughness to steel, a fine lustre to silver, and when added to carbon used for arc lamps it increases the brilliancy of the light. Further, mixed with carbon it yields a product hard enough to scratch a diamond. It has a strong affinity for nitrogen and promises a cheap means of preparing ammonia direct from the atmosphere.

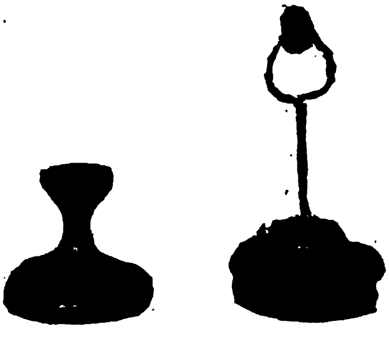
New Localities. —Perhaps the most pleasing thing to a mineralogist is the discovering of a place that will yield specimens, and, of course, the more diversified the species and better their quality, the greater is the pleasure. It is also a pleasure to record the finding of a new locality, some writers being content to describe the place and its products. Again others are made happy by the acquisition of as good specimens as they can afford from a new locality, even though they already own specimens of the same species or variety from older localities 'Tis thus the world moves.

Covellite, an indigo-blue ore of copper, is a result of the alteration of other ores of copper, and is composed of sulphur 33.6, copper 66:4. Hexagonal crystals are rare: commonly massive or with crystalline surfaces. Soft, 1:5. Covellite but a few years ago was a scarce mineral in good specimens, and all sold here were imported. Now there are several important American localities. It occurs massive in fine indigo-blue color at Butte, Mont. Also at the La Sal Mine, Utah, and in plates in Rio Grande Co., Colorado. It is also found in Wyoming.

Hauerite is a manganese disulphide, and is found in octahedral crystals imbedded in clay at Kalinka, Hungary, and also at Radussa, Sicily. Because of the soft matrix the crystals are generally sold loose, and one of good form, one-half inch in size, sells for 25 cents. Crystals one and a half inch in size sell for $12.00. To the young collector this rapid advance in price seems unwarranted, both in relation to this and other minerals, probably because he thinks the price arbitrary with the dealer. But in the matter of size nature is the arbitrary factor, for she seems to produce a disproportion of small crystals in some minerals. It is difficult to get enough large crystals of a good many minerals to meet the demand for them.

Platinum is so much in demand and the supply is so small that consumers of the metal are advertising methods to be used by placer miners for the saving of the mineral. Platinum is usually found in black sand containing a large percentage of magnetic iron ore and varying quantity of gold. The ordinary riffles in a gold saving flume cannot be relied upon to save a considerable proportion of the platinum, which occurs usually in fine flakes, and a durable concentrating surface which will hold the particles securely is required. This requirement is found best in cocoa matting fitted into a box with an iron screen for the gravel, giving the box a steep incline and regulating the flow of sand and water by strips at head of box.

New Mines. At Kingman, Arizona, several veins of rich tin ore have been discovered. Near Tucson there have been located several claims which contain large quantities of hydro-magnesite from which Epsom salts and similar medicinal products are made. This magnesite will have to compete with the Grecian products, which is laid down in America at $7.00 per ton. A valuable deposit of tungsten has been uncovered near Wilbur, Col.



STANDS FOR CRYSTALS.

Mounting Crystals on turned wood stands is a convenient method for the handling and for a uniform arrangement of specimens. The advantages are many and where recognized have been accepted by advanced collectors. We recently saw in a private cabinet upward of 1,000 of these mounts arranged in drawers, the stands separated by a narrow strip of wood, and they presented a neat and attractive appearance. This method of mounting is not new, as it has long been used to securely place very small crystals. But since the collecting of loose crystals has become such a vogue with a large number of mineralogists, the use for these stands has been much extended. The wood stands, nicely japanned, together with the necessary wax for fastening crystals, may be had of any dealer in minerals.

The estimates of the mineral products of the United States for 1901, given out by the Treasury Bureau of Statistics, indicate that we lead all other countries in the production of the following minerals:

Gold	$80,218,800.
Silver, ozs	59,653,788.
Pig iron, long tons	15,800,000.
Coal, long tons	267,850,000.
Copper, pounds.	595,000,000.
Petroleum, barrels	66,000,000.

Gold in Madagascar.

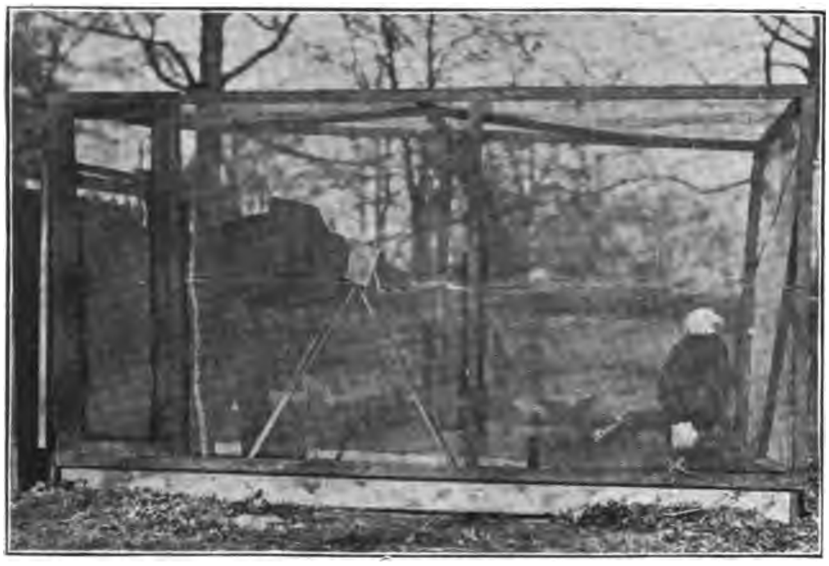
News recently received from Madagascar states that circumscribed auriferous regions, said to be very rich in the precious metal, are being worked on the eastern slopes and near the port of Manangary. The gold is in the form of small nuggets or of dust, taken from the alluvial deposit carried down by two streams from a neighboring mountain. Traces are found over the whole island.

Photography

BIRD PHOTOGRAPHY IN THE NEW YORK ZOO.

BY C. WILLIAM BEEBE, ASST. CURATOR.

In comparison with photographing in the woods and fields, taking pictures of birds confined in cages and aviaries might be supposed to be child's play, and indeed any one can get an image on a sensitive plate of a bird driven into a corner where it cannot escape. But, while the efforts of a naturalist photographer in the field are mainly directed to getting the bird in good focus, and near enough to be of satisfactory size, in a zoological park one's efforts must be toward arranging a suitable background, and then he needs only patience—and a plentiful supply of it at times—in waiting for the bird to assume a desired position, or to perform the certain action which it is the intention to permanently record in the photograph.



2.—PHOTOGRAPHING AN EAGLE IN WIRE CAGE.

No naturalist with any sense of honor would wish to palm off "Park" photographs as those taken of unconfined birds, but if the effect of appropriate and absolutely wild surroundings is obtained, a photograph, say of a Road-runner killing a snake in its unique way, is as valuable, scientifically, as if it had been taken in some arid western desert, which would be an all but impossible achievement.

In aviaries and ranges of such generous proportions as those provided for the birds in the New York Zoological Park, the inmates soon become perfectly at home, and thus, having no occasion to radically adapt themselves to a new environment, their habits, with easily distinguishable exceptions, are identical with those which they exhibit in a wild state.

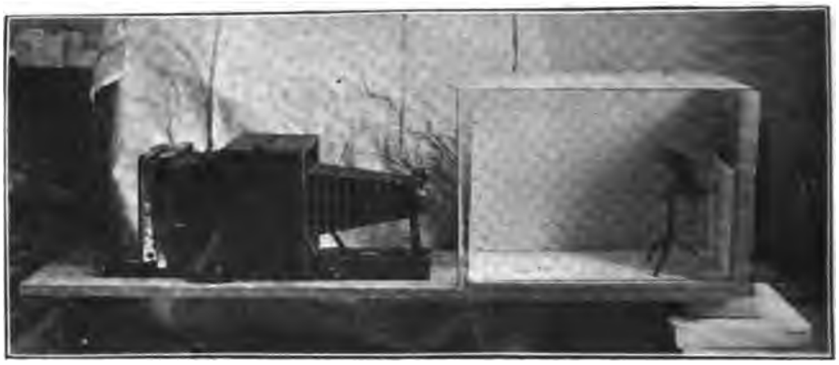
The illustrations show, roughly, the plan of procedure in photographing various birds. The first class, consisting of those which cannot fly, as Cassowaries, or which are pinioned in one wing, as ducks and gulls, are comparatively easy subjects, as they can be driven or tempted by food to a suitable place for photographing. For instance, a pair of Wood Ducks or Gadwalls may be placed at the edge of a pond, and by waiting until the unclipped wings are turned toward the lens, an exquisite picture may be obtained, or when a female of the former species selects the hollow in which she deposits her eggs, the camera placed near by will record her entrance or exit.

Cassowaries are very nervous at times, and when cornered and a camera is pointed at them, may lose control of themselves. At such a time, a stick, broom or convenient door is not unwelcome, as both operator and camera would be *hors de combat* after a well-directed kick from those terribly armed feet. Again, the bird may squat down, and neither force nor food can make it rise, until its Cassowary-mind is so inclined.

Another subject liable to give the photographer an unexpectedly warm reception is a male Canada Goose when guarding his mate on her nest. One approaches the hissing geese with eyes glued to the finding-mirror of a "reflex" camera, all unconscious of interruption, when a noise fortunately gives warning to turn aside, and the gander strikes one with the force of a battering-ram, and clinging with beak and feet to one's coat, rains blows with his hard wings until an escape is gladly made. A camera could never be of use again if once the bird struck it, and I have seen a keeper doubled up, with the wind knocked out of him from one of these furious attacks.

A second class of birds requires much more care and trouble in photographing. In taking pictures of large birds which are able to fly, as grouse, herons, eagles and owls, a confining cage is of course necessary (Fig. 2). This may be built against a bank of earth or large rock, which, with judicious use of branches, etc., may be used as a background. If a cage of fine-mesh wire is used, the wire must be thrown out of focus or hidden with leafy boughs. This kind of "studio" enables me to occasionally use the sky as a contrast in photographing dark-colored birds.

Finally, there remains the third-class of small birds whose motions are like lightning, and whose whims as "sitters" are most unexpected and exasperating. For this work a small cage or box has been devised (Fig. 3). One end of a long board is converted into a posing chamber, two sides and top being of perfectly clear glass, the rest of wood, over which frames of white, grey or black cardboard may be placed. In this I arrange an appropriate background, focus the camera on a perch which cannot fail to be utilized, admit the bird, and wait until the proper moment comes for pressing the bulb. Sometimes the bird must be left alone for two or three days until accustomed to the novel surroundings. If a large pine-cone is fixed upright and a hungry crossbill placed in the cage, for a time the bird will flutter against the invisible glass. One may continue one's studying or writing, with the bulb near at hand, and an occasional glance at the inmate of the cage, and in a short time the bird will yield to hunger and clamber over the cone, extracting the seeds in its unique way, and giving a chance to obtain an almost kinetoscope-like series of photographs of the process.



3.—PHOTOGRAPHING A BIRD IN A GLASS CAGE.

Photography by these various means may be made to contribute to every phase of ornithology. How many women, whose love for their aigrette-adorned millinery has been unaffected by petitions begging them not to contribute to the continuation of these murders, might not be won by an actual photograph of the beautiful bird—the rightful owner of the delicate filaments? (Fig. 4.) In a hundred other ways intelligent, scientific work in a zoological park will lead to as valuable and correct results as the work of a field naturalist, although to the worker himself nothing can make up for the exhilarating chase, the exciting stalks, the eager suspense waiting for the favorable moment which may occur but once, when in close proximity to a rare bird. But no one can show such well-rounned work, such grasp of subject, as the naturalist who divides his studies between dissections and books and captive objects, and those living wild in the woods and fields and waters.

4.—AMERICAN EGRET.
SHOWING "AIGRETTE" PLUMES.

A Use for Celluloid Films.

With a nail-brush and some warm water thoroughly clean away all traces of the gelatin coating or image-bearing film, so that you have nothing left but the clean celluloid. Lay this aside to dry thoroughly. Then cut up into small bits, place in a bottle and add methylated spirit, shaking the bottle occasionally. Adjust the proportions of celluloid and solvent (spirit) so as to get a fairly thick creamy solution. Apply this to the label and you have a water-proof varnish. Either a small brush or the end of a feather can be used for applying this varnish. This will not only keep the labels clean and legible, but will make them hold tight to the bottles.

Cinematograph for the Blind.

M. Marsillon, of France, has devised a double disk, each side with a border of like figures in relief, corresponding in position—for example, a bird in successive attitudes of flying; this is felt by the blind with stationary fingers, while the disk is rapidly whirling, producing the effect of a solid figure in rapidly changing movement.

Hall's Journal of Health

Founded by Dr. Wm. M. Hall, 1854.

THE TONGUE AND ITS CARE.

BY O. B. SALISBURY.

The tongue, besides being the natural organ of taste, has other duties to perform. It participates in the articulation of speech, and plays an important part in the chewing of food, in the act of swallowing, and in the cleaning of the teeth.

The upper surface, or back, with its sides and tip are free, whilst its base is attached by muscles to the lower jaw and hyoid bone. Here also enter its blood vessels and nerves. Folds of mucous membrane loosely connect it with the epiglottis and soft palate, as well as with the bones of the lower jaw. From beneath its rounded borders the mucous covering becomes continuous with the surface of the gums. The front two-toirds of the tongue occupies the floor of the mouth, lying between the halves of the lower jaw, with its rounded back overarched by the roof of the palate, and its sides and tip in contact with the gums. A slight lengthwise groove, the middle raphe, divides the back along its front two-thirds, ending rearly near a small depression. The rear third of the back, situated in the front wall of the pharynx, forms a rounded surface overhanging the epiglottis.

The mucous membrane on the back of the tongue is thicker behind than in front, whilst that of the under surface is thin and smooth. It consists of a layer of connective tissue, true skin or mucosa, supporting numerous special ripples or papillæ, and covered, as well as the simple touch papillæ, with a layer of cells, like that of the scarf skin. Of the special papillæ, the filiform are the most numerous of all, as well as the smallest. They are minute, conical, tapering or cylindrical eminences, which cover the front two-thirds of the back, sides and tip with faintly ridged lines. The fungiform are less in number, and scattered irregularly over the back. They are easily observed with a mirror among the others by their large size, rounded eminences, and deep red color. In children they are slightly developed, and in old age they are often wasted.

Toward the root of the tongue we find the largest papillæ, the circumvallate, seven to twelve in number, arranged in the form of a V. Each one presents a narrow attached base, a broad free end, and is seated in a circular cup which is surrounded by a second. They, like the fungiform and filiform, are studded with minute conical processes of the mucous membrane which form secondary papillæ. This membrane of the tongue is provided also with mucous and serous glands. The mucous glands are found all over its surface, whilst the serous glands occur only at the rear of the upper surface, The latter secrete a thin, watery fluid, and probably assist in distribution of the material to be tasted over the taste area.

In the scarf skin of the circumvallate papillæ and in some of the fungiform, certain peculiar objects called taste cones or buds, have been found. The cones occur also in front of the anterior pillars of the fauces, the front surface of the soft palate and on the rear surface of the epiglottis. They are flask-like in form, their broad base resting on the true skin, and their neck opening by a canal between the cells of the scarf skin. The inner spindle-shaped taste cells of the cones have a large round nucleus about the middle of the cell. Both ends are thread-like; the outer passes to the pore of the taste bud, where it ends in the taste hairs, which come in contact with the object tasted; the inner thread is often branched, and ends between the taste nerves. The intensity of the taste sensation depends on the degree of saturation of the solution tasted, the magnitude of the area excited, and the motion, diffusion, and pressure of the object tasted within the mouth.

The fur or coat, formed chiefly by the unusually large filiform papillæ, can be cleansed by eating solid food, especially dry bread. When the fur is abnormal it is usually due to derangements of the digestive organs. Micro-organisms and fragments of food are found. The increase in the thickness of the fur is often related to the neglect of keeping the mouth clean by brushing the teeth. Slight burns of the tongue are of frequent occurrence, from taking food too hot into the mouth. The burnt spot is painful and very tender for a while, and is redder and smoother than the rest of the surface of the tongue, or, perhaps, it is actually raw. The material is seldom so hot or retained so long within the mouth as to produce a separation of the true skin, or even to raise up the scarf skin, but superficial portions of the papillæ may be effaced and leave a smooth area. In the course of a few hours, and usually by the following day, the tenderness has disappeared, the burned spot has lost its extra red color, and the papillæ begin to form again. Such burns as these seldom need special care; but if the soreness of the tongue continues longer than usual, tannate of glycerine may be applied over the burned area, or a tablet or gargle of chlorate of potash at frequent intervals, until the annoyance ceases to be felt.

Wounds may be produced by eating with sharp knives and forks, but by far the commonest wounds are those which are made by the teeth. As a rule, bites of the tongue are not serious accidents, and require no care or no other than one of the above remedies.

Smokers' patches are intense white spots on the mucous membrane of the tongue, due to smoking. Those on the sides of the tongue are often notched, giving them a scar-like appearance. They consist of thickened scarf skin, which disappears to be replaced, and rarely give rise to inconvenience, unless painful, when one of the remedies for healing burns may be applied. Hot and irritating substances should be kept from the mouth and smoking dispensed with. If simple remedies are not effective in the earlier stages of the disease, a physician should be consulted

Excessive Beer Drinking.

The excessive use of beer is found to produce a species of degeneration of all the organs. Profound and deceptive fatty deposits, diminished circulation, conditions of congestion, perversion of functional activities, and local inflammation of both liver and kidneys are constantly present. A stupor amounting to almost paralysis arrests the reason, changing all the higher faculties into a mere animalism, sensual, selfish, sluggish; varied only with paroxyisms of anger that are senseless and brutal. In appearance the excessive beer drinker may be the picture of health, but in reality he is most incapable of resisting disease. Compared with inebriates who use different kinds of alcohol he is more incurable, and more generally diseased. The constant and inordinate use of beer every day gives the system no recuperation, but steadily lowers the vital forces.—Fam. Doct.

Felons.

There are two kinds of felons—one under the skin, readily cured, the other immediately on the bone and under the fascia, or tough covering of muscle. The felon being in the nature of a boil, swells, rises up, but the fascia being so impenetrable, cannot break as the skin does, hence the pain is more intolerable. A boil, or superficial felon, rises, pierces the skin, breaks, runs itself out, and gets well. The matter of a bone felon cannot escape, but remains in its place, irritates, inflames, and gives a pain second only to the rack; but pressure and heat cause the matter to be absorbed at last, and the martyred wretch gets well slowly, and after a long time. There are two ways of treating a felon, as there are two kinds of felons. If superficial, put a fly blister on the spot at once, about the size of the thumb nail; let it remain six hours, when the felon or core may be seen immediately under the blister, and may be picked out with a needle.

Constant Coughing.

Constant coughing is precisely like scratching a wound on the outside of the body. So long as it is done the wound will not heal. Let a person when tempted to cough draw a long breath and hold it until it warms and soothes every air cell, and some benefit will soon be received from this process. The nitrogen acts as an anodyne to the mucous membrane, allaying the desire to cough, and giving the throat and lungs a chance to heal. At the same time, a suitable medicine will aid nature in her effort to recuperate.

Unhygienic Chairs.

A young lady of small stature recently fainted at a dinner given in her honor. It was then found she had not been able to touch either her feet to the floor or her back to the chair; and the restricted circulation and prolonged discomfort had finally overcome her. An antiquarian traces the present mania for high seats to the fact that at the old French courts, sets of handsome furniture were ranged along the walls for effect, but never occupied. The chairs and sofas actually used were much lower. Furniture makers of to day copy the more showy pieces, and further enhance their inutility by spring cushions. The dictum of a famous cabinet-maker is that in choosing chairs the knee of a person standing should come clear above the seat he intends to occupy.

The Eye Injured by Sun-gazing.

A man, in May, 1900, imprudently observed for some time the partial eclipse of the sun with his eyes unprotected in any way. No effect was noticed until late in the day, when in looking over the hillside he saw apparently a flock of eight or ten red birds whose movements were very erratic. Since the birds appeared wherever he looked, he carefully examined the field of vision, and discovered that the sun had formed a crescent image on the center of the retina of the left eye. The color of the image was green with a narrow red border. The injured area seemed to be quite blind, and parallel lines diverged around it, this effect being just the opposite of the previous case. The injury is always noticeable and very annoying, especially in reading. The effect is noticeable after a year. In a similar case the effect lasted ten years.

Vaccination and Lockjaw.

The recent epidemic of tetanus in Camden, N. J., prompted the local Board of Health to send out a circular giving the facts. From this it appears that a bacteriological examination of the vaccine matter used in Camden showed it to be free from tetanus germs. The reason for the epidemic is found in the prevailing weather conditions, combined with carelessness on the part of persons recently vaccinated. There had been a long spell of dry weather, accompanied by high winds, which raised the dust, so that that there were tetanus germs constantly present in the atmosphere. Infection resulted when the scabs had been removed, and the germs gained access to the wound.

Color of Tea.

A bulletin of the Tokyo agricultural college says that the color of green tea is not caused by copper salts necessarily, but is due to the fact that green tea is made from leaves dried as soon as they are picked, while black tea is allowed to ferment first. The fermentation neutralizes some of the tannin, hence black tea is not so injurious as green.

Various Topics

HAWAIIAN LAVAS.

BY H. E. W.

The Hawaiian Group is composed of twelve islands, the summits of gigantic mountains rising suddenly from the bottom of the ocean. They are volcanic. No rocks other than volcanic are found upon them, excepting some consolidated coral sands.

The most famous volcanoes of these islands, if not of the world, are Mauna Loa and Kilauea. They are notable for the quiet character of their eruptions. Only once or twice have they been accompanied by earthquakes or subterranean rumblings. The lava wells up like boiling water from a hot spring, the explosive forces are so mild that persons can stand without danger, near enough to feel the heat in the face. The outbreak takes place without warning and it is only in the evening, when the sky is aglow and the fiery fountains are seen playing, that the inhabitants know of the eruption.

The lavas of all the islands are basaltic and there is considerable range in the variety of basalt present. A few varieties, as the lavas of Mauna Loa, abound in olivine and augite. There are two forms of lava, called by the natives pahoehoe and oa.

When the lava is discharged from the vents high up on the volcano, it is very hot and liquid, flowing at the rate of fifteen or twenty miles per hour, and often reaching a distance of eight or ten miles before any difference of temperature is observed. As it cools it becomes more viscous. Cooling first on the surface of the mass, this is often broken by the pressure of the hot lava within, which flows out in rivulets preserving their liquidity for a short time and spreading out very thin cools rapidly, thus forming pahoehoe in smooth and wrinkled hummocks. As the lava cools, it is overflowed by a similar mass, and this process is repeated.

The oa is said to have been formed by "the flowing of large masses of lava while in a condition approaching solidification."*

The fields of oa are very thick and cover large areas; like a huge glacier it moves very slowly when almost cold, perhaps only a few hundred yards or feet per day. They crush throughout the entire mass, splintering and fissuring, forming a chaos of angular fragments containing many clinkers, either detached or partially agglutinated together, with sharp, jagged angular fragments of a compact character projecting up through them. The oa streams are always thicker than the pahoehoe and rise from 50 to 80 feet above them, being bounded by a margin of low cliff and talus. Both varieties may often be seen in the same stream of lava.

Kilauea is the greatest volcano on the

islands. When the lava is freshly exposed in the lake, it has the appearance of melted cast iron, its color shading from red through orange into yellow.

Liquid lava coming up from great depths always contains more or less water, which is expelled as the lava solidifies and the water-vapor separates the lava into minute vesicles, the walls of which may be drawn out like glass, forming what is called Pele's hair. A bunch of it resembles finely shredded asbestos. Pele's hair is abundant and may be gathered in wisps where caught by some projecting rock.

In some places in the southern part of Kilauea, the black color of the lava has frequently been changed by reaction of acid vapors, into a snowy white, or to an orange, red or saffron color. The pit of Kilauea is riven by faults. Numerous fissures from two to six feet in width traverse the platform. From nearly all fissures issue hot steam and large quantities of sulphur vapor which condense in the form of arborescent and acicular crystals of sulphur, and are very beautiful. At other places fumes of sulphurous acid are given off in abundance.

There are many heaps on the islands of a peculiar pumice, which is very light and spongy and of an olive-green color, the fragments not larger than a lemon and often much smaller. In some cases they are so light as to be carried great distances by the wind and are also seen floating on the ocean. Lavas present some curious forms according to the various circumstances attending the solidification. Sometimes taking the form of a matted and tangled mass of large ropes, from the lava having flowed over sharp ledges or down steep slopes. Flowing through ditches it has the appearance, in stone, of water running through a wooden flume. Others have the appearance of basaltic obsidian of a dark olive-green color.

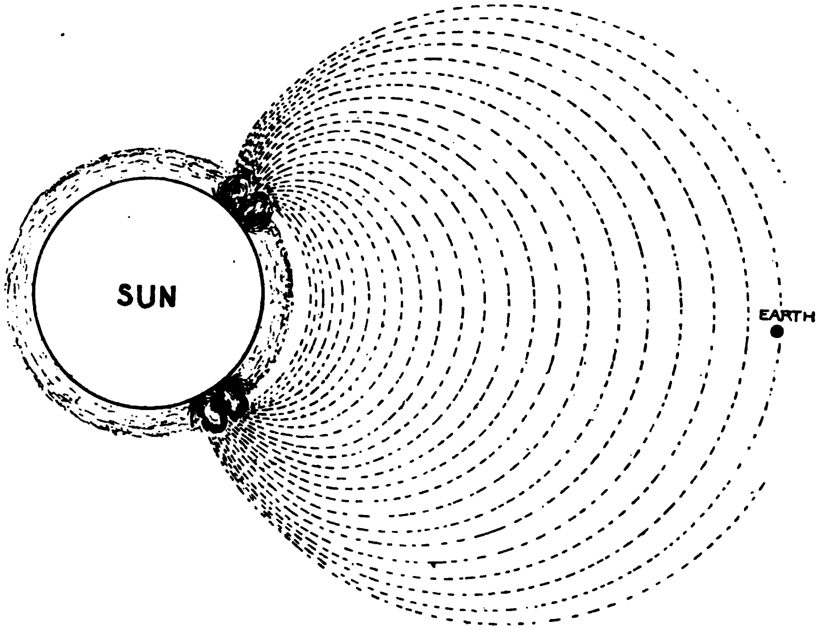
A stratum of red lava has been observed in the wall of Mauna Loa, almost 600 feet above the surface of the frozen lake. Mauna Kea lava is quite different from that of Mauna Loa. Olivin is present but not in such excessive quantities. Great quantities of feldspars are present in well marked tabular crystals, also large crystals of augite. In a number of cases the ground mass inclines to a bluish gray color, thus differing from the greenish black of most of the lavas of Kilauea and Mauna Loa. They are true basalts.

Of the five great volcanic piles which constitute the island of Hawaii, Kahola mountain is the smallest and also the first for its activity to cease. The lavas belong to the basaltic group, differing somewhat from those of Mauna Kea and Mauna Loa, in being less ferruginous and more feldspathic, and not so much olivin. Those intensely black, dense, and highly ferruginous lavas which are universal on Mauna Loa and Kilauea probably do not occur on the Kohalo mountain. Large peat bogs are found on Kohala.

SUN SPOTS AND ELECTRICAL DISTURBANCES.

Hudson Maxim, in the Electrical Age, explains the relation between the sunspots and electrical disturbance in the earth, as follows:

The temperature of the sun has been estimated at all the way from about that of the electric arc to millions of degrees Centigrade. The most conservative estimate, at the present time, and the most reasonable, is that the temperature of the solar surface is about four times that of the electric arc. Now, if we assume that the temperature of the solar globe itself is considerably above the volatilization point of carbon, and that upon the outer surface of the photosphere the temperature becomes so reduced as to form great clouds of condensing carbon, then we have with carbon for our chief condensing medium, a condition like that we have already described for the earth after it had cooled down to that point where water in a liquid state could reach its surface to be evaporated and thrown into the sky again.



The above diagram is intended to illustrate the manner in which Hertzian waves or similar etheric vibrations cause electrical storms upon the earth during periods of great solar disturbances, especially when great sunspots appear. A vertical section of two great sunspots is shown in the diagram with the intention of conveying the idea of their vortexial character. Of course, the size of those idealized spots and the depth of the solar envelope, as well as the size of the earth, are much exaggerated, as compared with the enormous dimensions of the sun's body.

It is probable that the chief medium of conveyance of the solar heat to the photosphere is volatilized carbon, and that upon the solar surface there is a downpour of carbon rain of stupendous volume. Who knows but these carbon rainstorms may send lightning flashes with disruptive electrical discharges to account for the electrical display which we see manifested in the corona?

It is probable that the body of the sun is not a liquid or molten mass, but consists of vapors heated to a temperature beyond the critical point, and owing to the great gravity of the metallic vapors, the density reaches to about that of water upon the earth. The sun has about the weight of an equal volume of water. Although the photosphere is pregnant with metallic vapors, still the great bulk of the metals lie underneath the photosphere and form the body of the sun.

As the heated currents move upward through the sun's atmosphere or surrounding envelope, they acquire an ever increasing velocity toward the radiating surface, and which is sufficient to carry them to great heights beyond it, spreading out and enormously increasing the areas of radiation. These currents are balanced by counter currents of denser matter, or that which has condensed from loss of heat, and which flow downward to the sun's surface. We may therefore reasonably imagine the entire surface of the photosphere to be in a state of violent agitation. Sometimes many upward-rushing currents of heated matter on cooling unite in a common descending column.

This action naturally creates what is known as Rumford vortex rings, such as are sometimes witnessed arising from the funnel of a locomotive, or blown from the mouth of a cigarette smoker. These vortex rings, when once created on the sun, naturally acquire a whirling motion of great velocity, and increase in size and intensity of action until torn to pieces by their own fury. The outer circles of these revolving vortex rings mount to enormous heights, and the condensation from radiant heat and light naturally produces electrical disturbances in the ether of very far-reaching effects.

Now, if we imagine two or more sunspots at points far remote from one another upon the solar photosphere, we may conceive that they might set up Hertzian waves in the ether, among other electrical phenomena, which waves, from the great altitude of the solar disturbances and their wide separation and the enormous intensity of action, could encircle the earth and all the planets of the solar system within their zone of influence.

I have now referred merely to the possible electrical effects of sunspots. It is practically certain that the coronal discharges which are witnessed about the sun's disk during an eclipse are electrical in character and resemble to some extent the aurora borealis or northern lights. If the coronal disturbances are due to thermo-electrical differences, we should therefore expect to find disruptive discharges, or at least electrical discharges of high oscillation, capable of producing secondary effects, such as the Hertzian waves, or some similar type of ether vibration.

At any rate, when there are periods of great solar disturbance, there is upon the earth a corresponding period of electrical disturbance, known as electrical storms. Great differences of potential between points on the sun far remote from each other, or induced by solar disturbances of colossal magnitude and intensity, as easily bridge the 92,000,000 miles which separate us from the sun, as the apparatus of wireless telegraphy the space intervening between separate corners of the laboratory.

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ELECTRICAL INVENTION REVIEWS.

BY R. I. GEARE.

Some of the most notable inventions during the last century, which may justly be regarded as the most brilliant period in the world's history, concern the practical use of electricity—such as telegraphy, the dynamo and motor, and the various kinds of electric light.

The inventions covering the telegraph embrace four essential parts, viz, the battery, the conducting wire, the electro-magnet, and the receiving and transmitting instruments. It is well known that in 1790 Galvani discovered that a frog's legs showed violent contractions when its nerves were touched with one metal and its muscles with another. This was due to the electric current generated. In the years following, much experimenting was done.

Nearly a half century after Galvani's discovery (1790), Professor Daniell, of London, invented the battery, which received his name. Then came those of Grove, Smee and others. The fact that electricity could be conveyed by a metal conductor had been known a long time, but it was not till 1825 that the discovery was made by Weber that a copper wire which he had fixed between two points in Göttingen needed no special insulation, and a few years later Professor Steinheil learned that the earth could be used as a return medium. To Professor Joseph Henry, the first secretary of the Smithsonian Institution, must be given entire credit for the electro-magnet which he invented in 1828, although his success could hardly have been realized, had it not been for the prior discovery of electro-magnetism by Professor Oersted and others. The electro-magnetic telegraph and alphabet were invented by Professor S. F. B. Morse in 1832 while crossing the Atlantic. Numerous inventions have been based on the electric telegraph, such as the printing telegraph, railroad signals, hotel annunciators, etc. The most important outgrowths of the telegraph, as originally completed, are methods by which from 4 to 8 messages are sent simultaneously over one wire: telegraphing by induction, as in conveying messages to moving trains, and wireless telegraphy, in which electric waves are generated at a high point and transmitted many miles over land and sea.

The success of wireless telegraphy has already been widely demonstrated. Many of the large steamships are now fitted with this apparatus, such as the Lucania, Umbria, Deutschland, Kaiser Wilhelm der Grosse, and others. The New York Herald has established a station at Nantucket for communicating with incoming vessels, and when forty miles or more away the operators are able to receive the most important news, which is communicated to the home office some twelve hours before the vessel reaches port. The elaborate operations of the American Wireless Telephone Company in disseminating the news during the process of the recent yacht races was a revelation in wireless telegraphy. This company is now erecting a station near the U. S. Life Saving Station at Barnegat City, from which point important service can be rendered in reporting vessels in distress, sending reports of passing ships to the press, etc. It is proposed to erect additional stations all along the coast.

As early as 1809, the electric light was discovered by Sir Humphrey Davy, and with the invention of the dynamo its use developed very rapidly. The enormous electric beacon made by a Frenchman, and exhibited at the World's Fair in 1893, was capable of producing a nine foot beam of ninety million candle-power. It would be visible nearly a hundred and fifty miles if the topographical difficulties could be overcome. There is a searh-light at the top of a mountain near the California coast of three million candle-power whose light, it is said, can be seen 150 miles out on the ocean. The arc and incandescent lamps are other forms of the application of electricity to lighting purposes, and these are now so familiar as to attract little attention.

Prof. Walter Nernst, of Göttingen University, who has long been conducting experiments on various kinds of luminous substances, has invented an electrolytic lamp called after his name. It is said to be very effective, and in candle-power, steadiness, color of light and ability to throw the light down where it is needed, the Nernst lamp will, it is believed by many, prove superior to the now well-known carbon lamps. The color of its light is midway between the yellow and red rays of the incandescent lamp and the violet and blue of the arc lamp.

Less than fifty years ago the only means of producing electricity for practical use was by means of the voltaic battery. The advent of the dynamo has extended the use of electricity immeasurably. The dynamo has been well described as "a machine which converts mechanical power into electricity." Thus, if a dynamo be attached to a steam engine, its power acting through the dynamo, will become a powerful electric current. In 1831 Prof. Henry devised the electric motor, and since that time numerous forms of motors have been invented. Eight years later a Russian applied his electric motor to a boat capable of carrying fourteen people, and about the same time a Scotchman introduced electricity as the motive power for a railway car. The printing of a newspaper by means of an electric motor followed soon afterwards, while in 1851 an electric locomotive drew a train of cars from Washington to Bladensburg at the rate of nineteen miles an hour. To Baltimore, however, belongs the honor of the installation of the first electric railway in America. This occurred in 1885. The extraordinary growth of the electric railway, and the saving of time and promotion of the passengers' comfort which its introduction has afforded, are too well known to need special mention. The power of the electric locomotive seems superhuman. Take, for instance, the one made about five years ago to draw trains through the long tunnel between Camden street and Mount Royal station, in Baltimore. This locomotive, which weighs 96 tons, pulls trains of 5,000 tons weight at the rate of 35 miles an hour. It has two trucks and eight drive wheels of 62 inches in diameter. Each of its four motors are equal to 360 horse power. Since that time still more powerful electric locomotives have been put in use.

There are now more than 15,000 miles of electric railroad in the United States, employing about 200,000 men, with a combined capital of more than a billion dollars. The various uses to which electricity is now applied, such as medicine, blasting, welding, electro-plating, its application to musical instruments, etc., are too numerous even to mention.

The use of gas for illuminating purposes now seems so antiquated, especially after observing what has been done with electricity for the same purposes, that it is almost superfluous to speak of it. And yet a hundred years ago, Murdoch, an Englishman, was doubtless loaded with praise when he discovered a way to light up the works of a firm manufacturing steam engines at Soho, near Birmingham.

Probably the first theatre lighted with gas was the "Lyceum," in London, in 1803.

One side of Pall Mall was similarly illuminated four years later, this being the first instance of street lighting by gas on record. About the same time it was used in the United States, and we read that David Melville, of Newport, R. I., in 1805 invented a gas apparatus for illuminating his house; water gas was discovered in 1875, and acetylene gas, although discovered in 1836, was not used for illuminating purposes till 1893. Coal oil was discovered in the United States in 1859, and the first village believed to be lighted by natural gas was Fredonia, in New York state, in 1865.

To Prof. Bell is due the invention of the telephone. His first patent (No. 174,465) was granted on March 7, 1876, and his second one (No. 186.787) on January 30, 1877. It was not without a great deal of vigorous contention on the part of many who claimed the invention, that the former of these patents was secured. Perhaps the man who came nearest to procuring a share of the honor was Elisha Gray (lately deceased). He filed a caveat upon the same day (February 14, 1876) upon which Prof. Bell made application for a patent. He was unsuccessful, however, as were many others, such as Edison, Richmond, etc. One of the earliest forms of telephone was known as the "lovers' telephone." It consisted of two cans, one end of each being covered with cat gut, or some vibratory tissue. Connected to this was a piece of strong cotton or wire. The result was of course satisfactory only for short distances, but no doubt exceedingly gratifying to the person at either end!

In 1860 a poor German school teacher named Reis, invented a telephone with the aid of a coil of wire, a knitting needle, the skin of a German sausage, the bung of a beer barrel, and a strip of platinum. Its efficiency was limited to the transmission of musical sounds or any loud, discordant noise. This restriction was due to the form of contact which he used in the transmitter. In 1874, however, Prof. Bell secured a patent for his telephone, which was based upon an entirely different princple. Unlike Reis, he did not call into use the aid of the "make-and-break" piece, but without breaking the electric circuit, devised a means by which a human tone could be transmitted. Its principle was based upon the action of induced currents, it having been found by Oersted (and since developed into a well-known fact) that with the withdrawal or approach of a piece of iron to the helix of an electro-magnet, an induced current will be generated. So in this case, a very thin piece of iron was placed in such a position before the helix of an electro-magnet, that the sound waves proceeding from the mouth of the speaker would cause the vibration of the disc. At the other end of the circuit the undulations were similar to those produced at the sending end, and accordingly the same sounds were registered.

The plan of action has since been greatly elaborated, and the usual form of transmitter of the present day employs very fine carbon granules as a vibratory medium, into which the two circuit wires are introduced. The form of receiver is similar in action to the first transmitter, and has been found to answer every purpose. The next surprise in this direction will doubtless be the perfecting of the telephone for submarine use, and its success indeed seems already assured.

Probably the latest typewriting machine on the market is the Cahill electrical typewriter. The special advantages claimed for it are the removal of the physical and nervous strain of writing, an increase in speed, and uniformity and clearness of impression which, as the prospectus states, "is unattainable on non-electrical machines." With this machine twenty carbon copies can be made, the last of which, as the writer can attest, is equal to the third or fourth copy made on any other machine. The phonograph was invented by Thomas A. Edison. who had long sought to devise a means of reproducing as well as recording sound. For some time it was thought that the phonograph would do away in large degree with the services of the stenographer, but this has not proved to be the case. Earlier attempts in the same general direction had been made before Edison's invention, but these only resulted in making records of sound waves. The machine as invented by Mr. Edison was perfected by Mr. Alexander Graham Bell and two of his associates. The completed phonograph was styled the "graphophone," but the principles were essentially the same.

A combination of the objects of the telephone and the phonograph has been produced by Mr. Waldemar Poulsen, of Copenhagen. It is called the "Telephonograph," and is capable of both recording and reproducing the most delicate sounds. It has been proposed to utilize this machine as a 'talking newspaper,' an idea already put to practical use in Budapest by means of the 'theatro-phone.'

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SHALL OUR FORESTS BE SILENT?

BY B. L. PUTNAM.

The passing of the buffalo is now acknowledged as a nation's disgrace. Yet with human inconsistency we continue the slaughter among the smaller animals, until it threatens almost as certain extermination in many instances. It was Ruskin who declared that if an angel should descend to earth, all the gunners would at once have their weapons pointed at the strange winged visitant. Farmers are awakening to the fact that the predictions of the English master of art have been already many times verified in the slaughter of insectivorous birds; and on every side there is felt the serious necessity of righting the wrong already done and checking further devastations.

Where quail, grouse, and prairie chicken were once as familiar as the omnipresent English sparrow, they are now almost strangers. Yet the tenacity with which they cling to the old haunts, and, when given close legislative protection, speedily recuperate their lost forces, is at once surprising and pathetic. Says John S. Wise, in the Review of Reviews: "When John Smith made his map of Virginia in 1607, he ornamented it with deer on the south side of the James River, about where the counties of Surrey and Sussex are now located, and with turkey on the peninsula between the James and York rivers, to show where these were most abundant. Three hundred years have passed since then, and a great many people have settled there, but deer and turkey most abound in Virginia still at the places designated by John Smith."

Yet those, which still maintain a foothold, have in many instance lost the old simplicity and trust. Wariness has proved a necessity to existence. As an illustration, the gray squirrel, common and social in our own Pennsylvania locality twenty years ago, is now rare. When surprised, it invariably springs to the first tree trunk, and promptly disappears on the opposite side, as if, when the intruder is hidden from it, safety is guaranteed. On reaching the upper limbs, it flattens itself out, and, protected by its color, it is quite difficult to discover among the branches. That these interesting creatures must be constantly in the position of the hunted criminal, destroys much of the charm of their life to the humane beholder.

Legislatures are awakening to a sense of the injustice done. The question is, will they move with necessary swiftness? Much has been done within the past year, but there is room for much more. In many states there is a limit to the game which can be killed by a single person during one day or season. Among game birds the one most generally protected is our cheery "Bob White," the export of which is prohibited in every state and territory with six exceptions. The prairie chicken is also practically prohibited to be sold beyond its normal range. This restricting of game birds to their own locality will check the growing desire to hunt.

Among the hopeful indications for the future, the greatest is the wide-spread interest in the subject, the general revision of legislation to that of a more stringent nature. The necessity of protecting birds during the migrating seasons is receiving much comment, and innovations along this line are probable coming in the near future. A novel feature in Nevada's new enactments is that requiring her game laws, which include measures for the introduction of game and the forming of game preserves, to be read in the public schools at least twice a year. This point, judiciously and sympathetically executed, will result in educating the coming generation to preserve the native fauna.

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TECHNICAL LANGUAGE.

Dr. Samuel Johnson is the great example of learned pomposity, especially in the use of long words of Latin and Greek derivation. When he would say look at mankind everywhere, he put it thus—"Let observation with extended view survey mankind from Pekin to Peru "

All sorts of doctors, scientific as well as literary, are prone to this stilted verbosity. With men of science, of course, there is a necessity of much technical language; but they employ it far more than necessity requires. A scientific mining engineer, T. A. Rickard, in an address before the American Association, very severely rebuked this tendency as in itself crude and absurd, and as hindering the progress of science.

He says, take this from a government report,—"The ore forms a series of imbricating lenses, or a stringer lead, in the slates, the quartz conforming as a rule to the carunculated schistose structures, though occasionally breaking across laminæ, and sometimes the slate is so broken as to form a reticulated deposit." This was written by one of our foremost geologists and, when translated, the sentence is found to convey a useful fact, but is it likely to be clear to anyone but a traveling dictionary?

Lens is a good word for anything lens-shaped, as indicating the shape; but overlapping would do as well as imbricating. Schistose can hardly be avoided, and is one of the most common terms in geology. But "carunculated," the dictionary applies only to the combs and wattles of fowls and the knobs of certain seeds. Call it knobby. "Reticulated" (net-like) many would understand, but not all who might be interested.

He gives another example—"a metamorphic matrix of a somewhat argillo-arenaceous composition," and translates it as a changed bed of a "clayey-sandy composition, which, in Anglo-Saxon, is m-u-d!" And he especially speaks of persons of superficial knowledge as often ambitious to use technical language and making a confused mess of it,—hiding ignorance under it. The common sense rule is to use common sense language, and technical terms only when indispensable.

THE HEAVENS FOR MARCH.

BY PROF. MALCOLM McNEILL.

The constellations visible during March evenings are about the same as those during February, save that they occupy positions shifted about two hours' motion toward the west. Ursa Major is in the northeast, high up near the zenith. Hercules is rising in the northeast, and Corona is somewhat higher toward the right. Bootes with its brilliant first magnitude star, Arcturus, is well above the horizon, a little north of east. The zodiac constellations, Leo and Virgo, extend from the eastern horizon nearly to the meridian south of the zenith. From the meridian toward the western horizon are Cancer, Gemini and Taurus. The brilliant group of Orion, Canis Major and Canis Minor, are low down in the southwest, and will soon be lost in the sun's rays. Auriga is high up in the west, and Perseus and Andromeda are low down in the northwest. Cassiopeia lies between Andromeda and the Pole Star.

Phases of the Moon, Eastern time:

Last Quarter,	Mar.	2,	5 h. 39 m. A M.
New Moon.	"	9,	9 h. 50 m. P.M.
First Quarter,	"	16,	5 h. 13 m. P.M.
Full Moon,	"	23,	10 h. 21 m. P.M.

Spring begins March 21, 8 A.M., and the sun crosses the equator from south to north.

March, 1902, is a very unfavorable month for evening observations of the planets. The only ones above the horizon are Mars, which is entirely too near the sun to be seen, becoming a morning star before the end of the month, and Neptune, which is too faint to be seen without a telescope. Observers who wish to see the planets will have to rise before the sun. The early morning display is fairly good.

Mercury throughout the month rises about an hour before sunrise, and may be seen, under favorable weather conditions, in the morning twilight. It is far south of the sun, and this shortens very materially the interval between the rising of the planet and the sun. The elongation from the sun at its maximum on March 17 is nearly the greatest possible, as the planet comes to aphelion only five days later. After greatest elongation the planet approaches the sun, and comes to superior conjunction toward the end of April.

Venus is also a morning star, rising somewhat earlier than Mercury, and is an easy object on account of its great brilliance. By the close of the month it rises about two hours before the sun. The planet is nearly stationary among the stars during the early part of the month, but the rapid eastward motion of the sun causes a considerable increase of distance between sun and planet. Venus comes to its greatest brightness again on March 21, and for some weeks about that time it may be made out by the naked eye in broad daylight. It is not a very easy matter to find it in daylight unless one knows where to look for it; but when once seen, it is so bright that the finder wonders how he could have failed to detect it at first glance.

Mars is very near the sun throughout the month, too near to be seen, and passes superior conjunction on March 29. It passed perihelion only a few weeks before, and its distance in miles from the sun is increasing rather rapidly. It therefore happens that its greatest distance from the earth is not reached at the time of superior conjunction, and it will not reach this point until nearly two months later. It will not gain much in brightness until autumn, and will not become conspicuous until winter.

Jupiter and Saturn are to be seen in the early morning. The eastward motion of the sun among the stars has carried it far enough away from the planets to make them easily visible in the early morning. At the end of the month Jupiter rises at about 3 h. 30 m. A.M., and Saturn about an hour earlier. Both planets are moving eastward in the constellation Capricorn, and their distance apart increases from 13° to 15° during the month.

Uranus rises about two hours earlier than Saturn, at a little after midnight toward the close of the month. It is nearly stationary in the constellation Ophiuchus, between Scorpio and Sagittarius. It is about 1° north of the variable *b* Ophiuchi, a small fourth magnitude star.

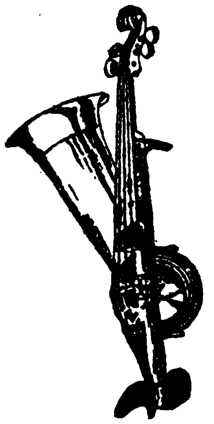
Neptune is in the western part of Gemini and does not set until after midnight.

To Remove Grease Spots from Books.

Grease spots, no matter how old, may be removed from books by applying a hot solution of potassium hydrate of varying strength from 3% to 5%, according to the age of the stain. To do this saturate a piece of thick bibulous paper with the solution and apply it to the back of the leaf. Place 2 or 3 leaves of bibulous paper on the front, turn the whole over on a narrow board, and with a hot iron go over the stain. If the first application does not remove the stain, repeat the operation. As the grease is removed dip another sheet of bibulous paper in water acidulated with 4% or 5% of hydrochloric acid, apply it to the back of the leaf in the same manner as before and iron until the paper is dry. This restores the faded printing and makes the paper bright and fresh. With fresh stains, bibulous paper saturated with carbon disulphide, benzin, benzol, ether, chloroform, or even rectified oil of turpentine, will answer. Wax yields to the same treatment, provided all surplus wax be first scraped off the surface.—N. Drug.

The Stroh Violin.

The Stroh violin, a new musical instrument, was introduced to a London audience recently by J. E. Muddock, who describes it thus: The vibrations of the strings are conducted by means of an ordinary violin bridge, which rests upon a rocking lever, to the diaphragm and resonator. The lever supporting the bridge oscillates laterally upon the body of the instrument, the end being attached to a diaphragm of aluminum by a small connecting link. The diaphragm is held in position between two india-rubber cushions by means of a specially-designed holder fixed upon the body of the violin by two brackets. Attached to this holder is the trumpet or resonator. The body or main support of the instrument is in no way employed for sound purposes. It simply holds the various parts of the violin together, and sustains the enormous pressure of the strings when tuned. The disc or diaphragm is perfectly free to vibrate, the result being that when the strings are set in motion by the bow the bridge and rocking lever vibrate accordingly, and thus every vibration is transmitted to the diaphragm. The diaphragm sets in motion the air contained in the resonator, the resonator augmenting and distributing the same to the surrounding atmosphere.


THE STROH VIOLIN.

The rich, mellow tones supposed to come only after at least a century's playing of a violin require no forcing. The slightest contact of the bow will bring them forth and make the player imagine himself a far better performer than he is.

Porcelain Violins.

According to Kuhlow's German Trade Review, a manufacturer of the Messein okarinas and porcelain organs has invented a process for the manufacture of violins and mandolines from clay; The porcelain it is claimed, is better able to produce sound than a wooden one, since it cooperates in the production of sound, making the notes soft and full. It is asserted that the porcelain violins possess the further advantage over the wooden ones that they are totally insensible to the influence of the weather. They are made in the earthenware factory, Sornewitz.

SIRIUS, THE DOG-STAR.

BY ARTHUR K. BARTLETT.

This magnificent star is the brightest in the heavens. It is unmistakable, as it shines forth with surpassing splendor in the southern sky in winter and early spring, in solitary glory, just to the southeast of that grandest of our constellations, Orion. Owing to its location in the heavens, being situated only about sixteen degrees south of the celestial equator, and nearly midway between the two poles, it is visible from every habitable portion of the earth.

In ancient times, when every man was his own astronomer, the rising and setting of Sirius was watched with great solicitude. The ancient Thebans, who first cultivated astronomy in Egypt, determined the length of the year by the number of its risings, and it was, to a certain extent, the almanac of the ancient Egyptians, who observed its rising with mingled apprehensions of hope and fear. Every year the appearance of this well-known star, just before the rising sun, was followed by the rising of the river Nile, and thus it was like a faithful watch-kog, giving warning of the approaching overflow of the waters, for which reason it received the name of "dog-star." To that season of the year when Sirius rose with the sun, and seemed to blend its own influence with the heat of that luminary, the ancients gave the name of "dog-days." At that remote period the days commenced on the 4th of August, or four days after the summer solstice, and continued forty days, or until the 14th of September. But the rising of Sirius varies with the latitude of the place, and in the same latitude is perceptibly changed, after a course of years, by what is known as the precession of the equinoxes. The modern "dog-days" extend from the 3d of July to the 11th of August, being one day less than the ancients reckoned, and it will therefore be readily seen that they have no reference whatever to the rising of Sirius with the sun, which occurs at present about the 12th of August. Sirius is with us overhead in the daytime during the so-called "dog-days," and consequently invisible, and is at night in the lower hemisphere, but is visible and conspicuous to us upon the nocturnal sky all through the winter.

Sirius belongs to the little constellation Canis Major, or the Great Dog, a group of 31 stars situated just south and east of Orion, and almost universally known from the unrivaled brilliancy of its leading orb, but which otherwise possesses no noteworthy attractions. A line drawn from the star Aldebaran through Bellatrix, toward the southeast, will indicate the position of Sirius, which forms, with Procyon and Betelgeuse, a large triangle, the sides of which are nearly equal. It is also pointed out by the three stars in the "belt" of Orion, its distance from them being about 23 degrees toward the southeast. When observed through a large telescope, Sirius shines with a brilliancy that is startling to the beholder. It is not only the brightest star in the heavens, but it is more than three times brighter than an ordinary first magnitude star, and is believed to be 500 times as bright as a star of the sixth magnitude—the faintest visible to the naked eye.

Owing to the remarkable size and brilliancy of Sirius, it was once naturally regarded as the nearest of the stars, but its distance is in reality so great that it has never been satisfactorily determined. The most reliable authorities, however, assign to Sirius a distance of 100,000,000,000,000 miles, which is five times the distance of Alpha Centauri—the nearest star known to astronomers—and a million times the sun's distance from our earth. Prof. Chambers, in his recent work, "The Story of the Stars," places Sirius as the fourth in order of distance among those stars experimented upon, whose parallax has been measured for the purpose of ascertaining their distances from us. It is estimated by some astronomers that the light of Sirius is 300 times greater than that of the sun, and if we assume that the intrinsic brightness of its surface is the same as the sun's, the surface of this star must be 300 times larger than that of the sun, from which it follows that the diameter of Sirius is about 18 times that of the sun, and its volume about 2,200 times greater. This splendid star is in reality a globe emitting so enormous a quantity of light and heat, that were it to take the place of our sun, every creature on this earth would be consumed by its burning rays. The mind utterly fails to comprehend the immeasurable distance which separates our earth from this stupendous orb. Light, which travels with the almost inconceivable velocity of 186,000 miles per second, requires 22 years to traverse the distance between Sirius and our earth, and if the velocity of a cannon ball could be kept up constantly it would require no less than 100 million years for the ball to reach this far-off star.

By means of the spectroscope it has been found that Sirius is receding from our earth at the rate of 26 miles per second; and yet, even with this almost incredible velocity, the passage of a thousand years will make no perceptible difference in the appearance of this star, so immense is the distance which separates it from us. Sirius, on account of its brilliancy and prominence, was regarded by Kant, the celebrated German philosopher, as the central sun of the universe, but his conclusion, though a grand and natural one, has been shown to be erroneous, and astronomers do not recognize any particular star as the center around which all the other stars revolve. It is believed that remarkable changes have taken place in the color of Sirius since it was first observed by astronomers. Sirius was described by the ancients as a fiery red star.

Many years ago it was said to be pure white, but it is now becoming of a green color, as a careful observer will readily perceive when this star is visible on a clear winter evening. Secchi, the eminent Italian astronomer, divided the stars into four types, according to their spectra, and Sirius belongs to the first type, in which it holds a leading position, and which includes the highest condition of development in the stellar universe. We may justly consider this glorious sun as the center of a system of revolving worlds, and imagine them as being inhabited by creatures far more advanced in intellectual development than ourselves.

The late Professor Proctor, referring to this interesting orb, says: "Sirius shines at least 200 times as brightly as our sun would shine if set beside it. Assuming its surface to be equally brilliant, this would imply, in comparison with our sun, a diameter 14 times and a volume 3,000 times as great. Its luster, however, seems higher than the sun's, but, even making allowance for that, we must still consider this giant sun to be at least 1,000 times as large as our own orb. Recent evidence tends to show that its rate of recession from us is diminishing, so that we may expect this to change into a motion of approach. Here is a hint that Sirius is traveling in a mighty orbit with movements carrying it alternately from and toward us."

One of the most interesting results of the observations directed to this wonderful star was the discovery that it is attended by a revolving companion or satellite, the existence of which had long been suspected by astronomers, and which was finally detected by mere accident. The presence of this object had been revealed by the effect of its attraction upon Sirius, the motion of which varied in such a way, as to indicate a powerful disturbing influence in its vicinity. The famous German astronomer, Bessel, about sixty years ago, expressed his belief that the periodical variations in the motion of Sirius were produced by the attraction of an invisible companion, revolving around the gigantic star. Several astronomers had calculated the orbit of the attracting body, and its distance from Sirius at various times, and though it was diligently searched for, it continued to elude detection, even by means of the most powerful telescopes. But in February, 1862, the 18-inch telescope which was being constructed for the Chicago observatory, was pointed to Sirius as a test of its power, when the disturbing companion came suddenly into view at a distance of about ten seconds from the large star, and exactly in the direction which had been predicted for that time. The period of its revolution around Sirius was found to be nearly fifty years, and within a few months of the period calculated by Bessel, long before the telescope had revealed its presence. When the news of its discovery had spread in every direction, all the great telescopes were pointed to Sirius, and it was found that when the exact position of its companion was known, it could be easily detected by skillful observers, even with smaller instruments than the one which first brought it into view, the visibility of this very interesting and difficult object depending almost as much upon the altitude of Sirius and the condition of the atmosphere as upon the power of the telescope employed by observers.

It is a remarkable circumstance that Voltaire, who, like Dean Swift in his "Gulliver's Travels," attributed to satellites to the planet Mars long before they were discovered or even suspected by astronomers, should also, in his story of "Micromegas," have imagined and described an immense orb revolving Sirius, many years before its existence had been revealed by the telescope. The hero of his wonderful story came from this imagined planet, and was described as a giant, more than twenty miles tall, who made a visit to the microscopic inhabitants of our earth. We find, then, that Sirius is a "double star," the two components being physically connected, and forming what is known as a "binary system," the smaller star revolving around the larger, or both around their common center of gravity. Owing to certain irregularities in the motion of the smaller star, which cannot be explained, some astronomers are of the opinion that Sirius has another disturbing companion, the existence of which is indicated by its attraction only, and which may eventually be discovered, either by one of the great telescopes already constructed or the still larger instruments now in contemplation.

Artificial Hair.

A new process of the Frankfort-on-the-Main Company makes possible the production of a horsehair of any length from cellulose or its derivatives. There was one difficulty, namely, that when the cellulose mass was pressed through an opening so as to form a hair, the hair was very weak when dry, and so brittle that it broke if it was attempted to tie a knot in it. This difficulty was overcome by spinning the hair from two or more openings of suitable size at the same time. These very fine threads unite into one as soon as they leave the perforated plate, and form a single hair of the proper thickness which has the necessary strength and pliability. The nitrate of cellulose is then denitrated and dyed like artificial silk. The hair shows under the microscope that it is composed of several lying side by side.

Hydrogen a Poison.

Hydrogen, hitherto regarded as harmless, is believed by Dr. J. C. McWalter, of Dublin, to act as a mild poison when long inhaled. The ill effects observed were in workmen of electric light stations, where accumulators giving off hydrogen, were used during a part of the day.

Correspondence

The American Bittern.

Editor POPULAR SCIENCE NEWS:

Among the birds of the swamp there are perhaps none better known than the big brown Bittern (Botaurus mugitans). I have met him on many Minnesota lakes and meadows, and have always found him the same interesting bird I thought him when first we met.

There was one that used to utter his call every evening in a swamp not far from our house. I paid him a visit one evening, and found him strutting around on a large grass tussock, going through all kinds of foolish antics. He would pause between his acts long enough to give his booming call once or twice, then off he would go again on his proud struttings and clownish performances.

I thought at first that I had stumbled on him while he was love-making, but changed my mind when I could not find another Bittern in the swamp. But the next night there was another and she came early.

She flew into the opening where the tussock was, and alighting about ten feet from it took on that rigid, post-like position which is the Bittern's greatest safeguard. She pointed her bill straight up, and looked so much like a piece of broken branch or stump, that it would be very easy to overlook her if you did not know she was there.

A few minutes later my friend of the evening before came back to his tussock. The first thing he did was to draw himself to his full height and send a long booming across the swamp. The female did not move a muscle but waited and watched. Then he repeated his antics and added a few new ones, but the female remained rigid.

In about half an hour the male left the swamp, then the female limbered up, and after a good look around she too left. After this I found this pair together every time I came to the swamp. But now the female did not become rigid when I disturbed them; she would lie low in the tall grass while the male raised his head and kept watch.

In the early part of August I found their nest. Its was in a clump of cat-tails in the center of the swamp, where there was a foot or two of water. It was a large clumsy affair of reeds, grass and cat-tails, clumsy indeed, but withal strongly built. The nest contained four eggs; they were of a chocolate-brown color and about the size of a common hen's egg.

When distured, the female would slip quietly from the nest and hide among the the reeds; they never fly from the nest but run some distance before taking wing. I took one egg, and when I returned the following day the nest again contained the usual compliment of four.

I was away for some days and on my return I found four brown, downy chicks in the nest. I can hardly say in the nest, for they climbed all over it and up the cat-tails it was fastened to.

Even while very young they travel as far about the swamp as the thick reeds furnish a roadway, but return again to the nest at night. They are very soon able to shift for themselves, and about the middle of September they go south, traveling at night.

C. William Gross.

Nature as Weaver and Jeweler.

Editor Popular Science News:

One morning, last summer, while camping at Lake Gogнac, Mich., I saw the most beautiful nature picture that I had ever before seen. During the night all the spiders had been seized with the same impulse, or prompted by some occult power, to spin webs. For miles and miles, as far as the eye could see, there were thousands and thousands of silken webs, some of the geometric form and others festooned from top to top of the tallest grasses, the weeds and bushes, looking like fairy telegraph lines. A dew had fallen in the night and rested in tiny drops upon the webs. It was a bright, clear morning and when the sun arose and its resplendent rays fell upon the acres of dew-besprinkled webs, it presented a sight beyond description. It was fairyland. The artistic forces of nature had been working in her laboratory and produced millions of precious gems that shed a silvery sheen over the landscape, dazzled the eye and electrified the brain. Every drop of dew was a diamond. The rays of the rising sun reflected and refracted from the jewels of Aurora, producing a splendor that rivaled an Oriental dream. Such scintillations of colors and glitter of light! It was nature's coronation, magnificent. No artist could paint a scene so lovely, so brilliant, so grand! No human lapidary could cut diamonds or polish precious stones that could reflect more lustre and beauty. Just the memory of that one morning re-creates its inspiration and I feel the benediction of nature come over me.

Charles Emmett Barnes.

Printing from Films.

Editor Popular Science News:

Films will curl, despite the most exact compliance with the manufacturers' directions for manipulation, and there seems to be no way to avoid the unpleasantness in printing. But the amateur who will use a printing frame of the size next larger than his negatives, will find his troubles greatly lessened. A 5 x 7 frame, for instance, will allow you to hold the film's corners down much longer than the 4 x 5 one, in which it fits. The fingers need not be withdrawn until the back is so nearly closed that the celluloid has little room left in which to curl, and the relief is great.

M. Victor Goodrich.

A One-Eared Hare.

Editor Popular Science News:

A one-eared Belgian hare is a freak of nature at Westfield, Mass. One of our townsmen is raising the animals for the market, and this specimen is one of a litter of several normal individuals.

It has its one ear planted plumb on top of the head. There is no indication that nature had any intention of producing a second ear. The one ear is perfect, and seems to supply all wants in the line of hearing satisfactorily.

A plausible solution of the phenomenon is available from the fact that there were, during the winter and while our subject was still unborn, several hares in the herd which had been forcibly deprived of an ear by the too active attentions of their companions. Hence it is very probable that the mother of our one-eared friend was unduly frightened during the period of her offspring's growth, the result making itself manifest in but one member of her family.

This member of the family is fully as large and healthy as any of his brothers or sisters, and but for the absence of an ear is perfectly developed in every respect.

D. M. Cole.

Tarantula Statements Queried.

Editor Popular Science News:

Calling attention to the interesting paper on Tarantula Hunting, in your January number: might an inquisitive party, as one well interested in the subject in hand, be permitted to bring a few questions to the notice of those better informed than himself, without meaning to reflect at all on the accuracy of the author?—as I infer that the items composing the bulk of the article are given on the authority of a second party, and not at first-hand observations.

I take it that the tarantula mentioned is Mygale hentzii. Is it a fact that this species erects a web at the entrance of its retreat to entangle its prey? and if so, can it be possible that the creature can construct a new web within five minutes, and, at the end of that time, be concealed awaiting its victums?

I have several specimens of this spider, and cannot, even through closest external examination, find that it has a "throat" that the tarantula hunter could readily discern to grasp with a pair of pincers.

Has there been any previous record of its ever having been so common in any locality as to "cover the ground", and is not this point open to question?

As to the tarantula hawks mentioned as being "of about the size and appearance of the common wasp": If these are the tarantula hawks that belong to the genus Pepsis, I understand that they are more imposing, both as to size and appearance, than most of the common wasps, and that their wings are yellow or orange with sometimes a darker margin, and not red and blue as mentioned. I have not seen it recorded elsewhere that wasps that provision their nests with spiders or other insects ever, in the adult form, "feast" on such provender themselves. Those of the genus Pepsis—in common with nearly all other fossorial hymenoptera—are phytophagous, deriving their sustenance from certain flowers, the spiders being reserved for the progeny in their larval stages. Is it known positively that these tarantula hawks eat any portion of the tarantulas before relegating them to their posterity.

A. Doubter.

The Cat-Bird Defended.

Editor Popular Science News:

Looking at the contents on first page of your February number, I noticed an article, "Habits of the Cat-bird," and as I have been very much interested in this bird, I turned first to the article. I regret to say that in my opinion the writer has, in his article, wronged the Cat-bird. From a boy I have been a great lover of birds, and have made them quite a study, not only from books but by observation.

In New Hampshire we have many of the cat-birds, and to me they are the brightest, happiest and most attractive bird we have. They build their nests as near dwellings as possible, in alder bushes near small streams. They feed mostly on berries and on tent caterpillars, and other worms. I have never known them to molest cherries, plums, or other garden fruit.

For several seasons there was a nest within a stone's throw of my garden, and the old bird never failed to visit me every summer. It would perch on a fence-post, making what I may call a teasing sound, until I threw her a worm, when she would fly down and pick it up, sometimes eating it, but more often flying to her nest for a short time, then return for more. As a mocking bird she will beat any New England bird at its own song.

She never makes trouble with her feathered neighbors, but resents an intruder, puts up a good fight and makes lots of noise. As to bee-eating, there must be some error in your contributor's observation. I am a bee-keeper and never have I seen the least sign of a cat-bird attempting to catch bees. Even king-birds are not half as destructive in this line as they are given credit. I would rather have twenty king-birds around an apiary than one toad, as far as destroying bees is concerned.

I have had many native birds caged, and the most interesting and attractive bird I ever had was a male cat-bird. Day after day I have watched these birds, and in my opinion we have not in New England a bird with so few faults and so much to his credit as has the cat-bird.

Fred. C. Gleason.

Submarine Oil Wells.

At Summerfield, Cal., there are now about 200 oil wells in successful operation bored along the beach or outshore.

Questions and Answers

QUESTIONS NOT ANSWERED.

Answers are solicited, especially for all questions so far without replies. Questions will appear but twice, successively. Those unanswered will then be designated by numbers. The following, need reply —297, 309–11, 318, 330, 333, 336.

333. Multiple Telegraphy. How can two or more operators use the same wire? I can conceive that many systems of waves can be simultaneous, but how about the mixing up of dots and dashes received?

WILLIE.

336. Worn Eyeglasses. Mine become worn by carrying them in pocket or case, so that the centres are almost like ground glass. How can they be polished again without further damage? MRS C.

337. Permanent Marking Ink. Could you oblige me with the name of a permanent marking ink for use with a rubber stamp on linen; I have tried several, but they have all been failures. W. S.

338. Boric Acid in Food. How can one who is not a chemist detect the use of this as a preservative of food? HYGIENE.

339. Spider's Neck and Wasp Food. Has a spider a neck by which it can be caught, and do wasps eat spiders, as represented in the recent article on the tarantula?

JABEZ

340. Scientific Names of Species. Why should these not be in English, instead of Latin and Greek, which many find hard to pronounce and retain, as well as incomprehensible? G. N. K.

341. Licking Postage Stamps. Microbes or no microbes, what is the harm, really? I have done it all my life. J. H.

342. Prof. Matthews and Loeb's Theory of Nerves. As stated in the papers, a part of the new theory is that the less solid components of the nerves and muscles are stiffened or gelatinized with every excitation. How about this when the action is rapid? Would there be 727 trillions of stiffenings (and by inference as many liquefactions or relaxations) per second when the optic nerves receive waves of violet light, this being the rate number of that color? INQUIRER.

343. Song Birds Talking. In Science, Jan. 31, a lady correspondent of Bird Lore is soberly quoted as reporting that a wild Rose-breasted Grosbeak was heard by her repeating the words "You are a pretty bird,—where are you?" and "Pretty, pretty bird, where are you?" The article gives other surprising statements. What do your readers know about birds literally and unmistakably talking? I never heard any do so except parrots. SENEX.

344. The Uses of Italics. What is the use of italic type, save to distinguish quoted words in foreign language? S.

345. Rate of a Fast Railroad Train. What chances of safely driving across a railroad track has a man when a train is coming at 40 miles per hour and is 7 rods distant? L. R. M.

350. Regarding a Leaky Faucet. There are two faucets at the kitchen sink—one for hot water and one for cold water. Recently the packing of the hot water faucet became defective, causing a drizzling nearly all the time. One would naturally suppose this leakage to be the most when the pressure is the greatest, but experience shows that it is exactly the reverse. There is only a drip, with now and then a very small stream, from this hot water faucet, when none in the house are in use. Upon opening the cold water faucet at this same sink, or either the cold or the hot water faucets in the bath room on the second floor, or one or more of the two cold water faucets and the two hot water faucets in the laundry tubs in the basement, then this dripping or drizzling stream from the defective hot water faucet in the kitchen becomes quite a large stream. Of course the pressure must be the most intense when water is not running from any other faucet in the house. Why is it that the hot water passes this defective packing in greatest volume when the pressure, as explained, is the least? E. F. B.

352. Subconscious Invention. The Weltermists in this section take great delight in pointing out that Edison always solves his problems and inventions practically while asleep; i. e., holding that invariably the solution of difficult points is done by the unconscious mind. Is there any foundation for such a statement?

DALLAS, OR.

353. The Wireless Telegraph Over Land. Can the wireless telegraphy (as it is thus far developed), be operated only at sea or over a body of water? DALLAS, OR.

354. The Origin of Rock Oil. As oil wells are being bored in this section at this time, there are offered many and varied explanations of the origin of oil. What are the most approved theories?

DALLAS, OR.

ANSWERS.

321. Sound of Steam Pipes. The hammering sound in steam-heating pipes comes very seldom from the pipes themselves, but from some radiator. When the steam valve of a radiator is closed, the steam which is left in the radiator, if not allowed to escape, will condense and remain in the radiator. If the radiator is large and a considerable quantity of water collects, the next time the radiator is opened there will be a cracking and thumping sound, which will continue as long as the steam and water remain at different temperatures.

The reason that there is a noise is that the steam, which is under pressure, is forced up into the water; the water being colder condenses the steam, but not before it has had time to form bubbles. When the steam is condensed to the point where it is no longer steam, then the bubble suddenly collapses, making the noise which may be carried along the pipes to other parts of the building.

When the thumping is in the radiator it may be prevented by opening the air-valve and allowing the steam to escape; when the noise is in the pipes the only way to stop it is to provide an outlet for the water after the steam has been turned off. Occasionally the noise is difficult to prevent owing to the fact that the water sometimes collects in some valve or turn in the pipe where it cannot get out. Even in this case the noise will stop when the pipes get hot. THOS. M. MUIR.

322. Do Fish Sleep? Someone has sprung a question on the fish experts of the government which they are unable to answer positively, and that is whether fish sleep. A careful search showed that there was no real scientific material on the subject, though it was argued from the hibernating habits of some species that it is reasonable to suppose that any fish might sleep. There have been numerous cases of gold fish frozen solid in the ice for a considerable time, which when thawed out resumed their normal existence. It is argued that during the frozen period they must have been in a comatose state that could be properly called sleep.

Fish in aquaria have been seen to rest for long periods without motion, save for that of the gills, though their eyes were open all the time. This latter phenomenon was to be expected, however, as fish have no eyelids and can not close their eyes. So far the information on the question of insomnia among the finny tribes has been only conjectural, and some very careful experiments will have to be tried to find a definite answer to to the simple question, "Do fish sleep?" PATHFINDER.

329. Waterproof Glue. Tannic acid, dissolved in water and added, is said to render glue insoluble. Another method recommended is to mix gradually glue and isinglass, separately dissolved and rubbed into a paste, in an earthern pot over fire, stirring continually, then add a few drops of linseed oil varnish, strain and bottle.

R. PARK.

331. Animals as Weather Guides. Before the cold snap in the first week of this February, the prairie dogs in Lincoln Park, Chicago, came out of their holes to eat, and it is said that the superintendent thereupon announced that cold weather was over for the season.

But the old notion that the actions of certain living creatures may indicate the coming weather seems to be not wholly unfounded. Prof. A. L. Clement, a French entomologist, has been collecting evidence to the point, and finds that tree-toads and various insects have been authoritatively credited with showing great sensitiveness to changes of temperature, humidity, air-pressure, and possibly atmospheric electricity. The geotrupes, a genus including the dung-beetle, are active on the coming of fine weather and quiet when a storm is coming, even when no visible sign appears. Bees and spiders, as has often been observed, keep at home when a storm is coming, the latter sometimes preparing their webs for resisting wind. JANUS.

332. **Non-Slipping Shoes.** A suggestion has been made that emery be mixed with the rubber of the soles in the process of manufacture. GALOSH.

334. **The Gyroscope.** A writer in the English Mechanic says that the explanation of the gyroscope is not difficult—that is, a general explanation. If a force acts in any direction, it requires the action of another force to change that direction. Now, when a wheel is made to spin on a horizontal axis, the wheel is acted on by a force which is called the centrifugal force, and which, of course, in this case, acts in a vertical direction. The plane of the wheel, therefore, tends to remain vertical, and it will require a force of a certain strength to turn the wheel aside from the vertical into a slanting position. A simple experiment will show this very well. Take a gyroscope—a small one will do—or other wheel capable of moving round an axle.

Take the ends of the axle in the hands, and as long as the wheel is not turning you will find no difficulty in turning it in any direction. Now set the wheel spinning rapidly, and you will open your eyes to see how it kicks against you when you try to turn it. Apply all this to the case in point. The gyroscope wheel is spinning rapidly, and while the axle is horizontal one end is placed on a support. The wheel will now be vertical. It cannot fall down straight, since one end of the axle is supported. To fall, it must first slant somewhat, but this the centrifugal force prevents, tending to keep it in the same vertical plane. As the velocity of the wheel decreases the centrifugal force decreases. Gravity gains the upper hand. The wheel begins to slant downwards, and continues to fall slowly, until at last the slant becomes so great that the end of the axle slips off the support.

OMEGA TAU.

334. **The Gyroscope.** The phenomenon of the gyroscope, in "keeping its wheel vertical," is readily deducible from Galilei's first law of motion, which, as re-stated by Newton, is: "If no force acts on a body in motion, it continues to move, uniformly, in a straight line."

Stated in this negative form Galilei's law is not made very lucid, and, besides, to what has been stated certain theoretical conditions should be in this statement which are quite as essential as the portion which is given, for a clear comprehension of the said law. These are, first, an absoute vacuum; second, entire suspension of he force of gravity, and no other force to ither retard, accelerate, or to laterally divert a moving body from its course then it will move, "uniformly, and in a traight line," forever.

Only a part of the last part of this law of motion, is essential for an answer to the submitted question, namely, the fact that this projectile moves in a straight line. With this law of motion well grounded in the mind, it becomes an "open sesame" for reasoning out all there is in this question. Let the effort be made for a moment, an hour, a day, or any longer required time, for the sake of the satisfaction resulting in such a victory.

Suppose that, in such gravitationless vacuum, a pebble and a bullet of equal size be projected, the pebble from the hand and the bullet from a rifle; then neither of these projectiles would depart from its course except by the action of a force across the line of direction of the moving body. The force required to change such course would depend on the weight and velocity of the projectile; it would be much greater for the heavier and swifter bullet than it would be for the pebble.

To bring Galilei's law into practical form, tie a string to the pebble, and the bullet, each about two feet long, and whirl them in a vertical plane and then let them go, horizontally. Two facts will manifest themselves through this experiment,—first, the heavier projectile will go the farthest; second, neither projectile will vary from a straight line to the right or left, or, more properly, each will move in a true plane, vertical to the direction of gravity, thus proving that it is gravity alone which diverts the course of the projectile from a straight line, while the resisting air brings it to rest; and in the fact that these projectiles move in a true plane there is an ocular demonstration of Galilei's law. This fact is as true for the whirled as the free projectile. They cannot be diverted from their plane of motion without a lateral force to which they will yield in a degree only, depending on the weight and velocity of the moving body.

Now consider the striking force, or impact, of each projectile, as compared with its weight, and therein the proportionately greater energy it would require to force such moving body out of its course; and conceive the rim of the rotating wheel to consist of a series of such projectiles secured to its axle; then, again, imagine the bullets and cords transformed into a solid wheel, and bear in mind the law which keeps it (them) in its direction, or its plane of motion: and, at the same time, consider how much greater the impact of this force is than the weight of the wheel, which, at its high rate of speed, is many times greater than the weight of the wheel, and therefore, the force and direction of motion of the wheel far exceeds the force of gravity; and, hence, the wheel can not fall when held at the end of its axle until that force runs down to or near that of the weight of the gyroscope.

While it is true that the motion of the gyroscope around its point of support seems to contradict this statement, in part, at least, it is not only not contradicted but, on the contrary, more fully confirmed thereby.

It must now suffice to say that other functions now come into play which are, however, not embraced in the present question and which cannot, therefore, be now touched upon. WM. ZIMMERMAN.

335. **Safety in Cars.** One would have to collect a great many statistics of accidents, to determine the chances of safety as to position of car in a train. Head on, the forward cars would suffer most in collision, but they would be safest in rear collision or when they reach firm ground while cars behind them fall with a collapsing bridge or spreading rails. In the matter of collisions, the central cars are of course least exposed, and might be preferable in a general way. But doctrines of chance afford little surety, for the destructive rarer chance may be the one that hits us.

H. W.

339. **Rate of Fast Railroad Train.** He would have about two seconds to cross and clear the track. CAUTION.

349. **Rate of Fast Railroad Train.** Any one who will divide 5280, the number of feet in a mile, by 60, will find that a mile a minute is 88 feet per second, and not 110 feet. Similarly 40 miles per hour will be ⅔ as fast, or 58⅔ per second.

W. C. PECKHAM.

327. **Raw Colors.** If it is landscape that Eugenia works on, the first thing is to train the eye to see colors in nature. The sky is not pure blue; it is azure, which is properly blue with a little red, and, according to hour, more or less slight admixture of yellow, which should be Naples yellow, for this can be used without a green effect. In fact, no color in nature can be realized by the use of a single pigment, unless it be some flowers. The green of trees is a variable compound; and all the effects can be had without employing black, which lessens luminosity in a mixture, especially after drying.

It is said that artists sometimes learn to see color by inverting the head. That confuses form, which suggests traditional false coloring, leaving only the true coloring to fix the attention. A visitor said to an artist, "I never see that color in nature." "Don't you wish you could," was the reply. AMATEUR.

328. **Colors and Complexion.** When one has a sallow complexion, one can "kill" it, as the phrase is, by having near the face something so much browner that the skin will seem devoid of brown, or by the use of dark green, this bringing out whatever there is in the face of red, the complimentary of green. The latter is rather preferable because when face and dress are both brown, the general effect is too uniformly brown. However, it is not unusual to seek a general dress-effect of one or another color. In any case, a brunette should not use light tints, that is delicate; a dark complexion may be counterbalanced by deep, warm colors.

AMATEUR.

CURRENT NOTES.

Santos-Dumont's Latest Exploit.

At Monte Carlo he stayed in the air 45 minutes, steering boldly out over the Mediterranean at a height of about 300 feet above the water. The balloon answered her helm readily and he had no difficutly bringing her back against the breeze to her shed on shore.

Long Distance Transmission of Energy.

A line has recently been put in operation in California which takes current from a power house at Colgate, in the Sierras, to San Jose, a distance of about 200 miles. Another line is now practically completed and it will deliver power, light, and heat in San Francisco, made by waterfalls 220 miles away.

New Mode of Preserving Eggs.

Mr. K. B. Baghot de la Bere, of Hinckley, England, says that an egg, when it is laid, is a wet egg (the shell is wet), and the longer you can keep an egg wet the fresher it will remain. Wet storing is the placing of eggs the day they are laid in water-glass, and leaving them there until they are sold or required for immediate use. It matters not whether they have been wet-stored a week, a month, or even five or six months, they continue equally fresh and always good alike. He has two nine-gallon barrels of eggs which he so preserved last spring and summer.

What Kind of Animal is It?

The papers, as on previous occasions, are agog with the discovery of an alleged giant's bones, this time in Guadalupe, N. M. The report says the bones of the frame could not have been less than 12 feet in length. The men who opened the grave say the forearm was 4 feet long and that in a well-preserved jaw the lower teeth ranged from the size of a hickory nut to that of the largest walnut in size. The chest of the being is reported as having a circumference of seven feet.

Dr. Suring's Late Balloon Ascent.

He found it necessary to breathe his compressed oxygen, at the height of 18,000 feet. When he reached his greatest height, 6¼ miles, he had already become unconscious. Dropping 15,000 feet, he regained consciousness, and found the temperature minus 40°. In Glaisher's record ascent to 7¼ miles, the barometer sank to 7 inches.

Prevention of Sea-Sickness.

Prof. Heinz, of the University of Erlingen, has given to the world a simple, and, he believes, an infallible antidote against sea-sickness. Draw a long and vigorous breath, he says, at frequent intervals, and you will never suffer from this malady. The reason, he explains, is because the initial cause of sea-sickness is to be found in the lobe of the brain, the sensitiveness of which reacts on the stomach, and that when fresh air is breathed at frequent intervals the blood becomes charged with oxygen, and thus the offending lobe loses its sensitiveness.

Salt Cure for Neuralgia.

Communicated to the Edinburgh Medico Chirurgical Society by Dr. George Leslie, it consists in snuffing or blowing a minutely little powdered common salt up the nose through the anterior nares. Dr. Leslie gave details of thirty or forty cases of facial and other neuralgia, cephalgia, odontalgia, etc., which had been cured, and he stated that he had only failed in two cases. Dr. Leslie's explanation is that the stimulation by chloride of sodium appears to induce in the nasal branches of the fifth nerve a form of motion which causes reflex inhibition of the pathological process in the nerves affected.

The Largest Induction Coil.

The largest induction coil, which produces the longest spark for service in wireless telegraphy, is said to be the one which was recently made for flashing messages between the coast of Japan and Korea. It can produce, in fact, a miniature streak of lightning 45 inches in length, capable of killing any number of persons who might get in its way, and when in operation sends out something like thunder rolls. The entire apparatus weighs about 2,000 pounds. A large amount, or 1,320,000 feet of copper wire, was used in its construction, and with a proper receiving apparatus wireless messages should be sent across a space of 500 miles. This immense coil requires about one horse-power of electrical energy for the perfect transmission of wireless waves, which are picked up by the "electric eye" of the receiver.

The Distribution of Blood.

The varying quantity of blood in parts of the body, according to exercise thereof, is weighed by Dr. Anderson, of Yale, who has a couch balanced on a knife-edge support. The most curious result is that even thought directed to a part of the body or imaginary exercise of it, sends blood thither; also that in gymnastics the degree of mental interest affects the flow of blood,—still more the zest in sports.

Blue and Green Vertebrates.

Two French biologists, Camichel and Mandoul, find that the blue or green colors of frogs, lizards and fish, are from pigment granules that vibrate with certain wave-lengths of light, and absorb the red which are useful to the organism while the violet, which are hurtful, are rejected; thus the skin is a sieve, and not merely colored for protection from enemies.

Carbonicution.

Prof. M. Berthelot, the French chemist, has suggested the use of carbonic oxide for the production of death for criminals, as employed for the destruction of stray dogs. He says that this is a quiet and painless death, and one that does not shock the sensibilities.

BOOK NOTICES.

The Cyclopedia of American Horticulture. Comprising directions for the cultivation of horticultural crops, and original descriptions of all the species of fruits, vegetables, flowers and ornamental plants known to be in the market in the United States and Canada. By. L. H. Bailey, assisted by many expert cultivators and botanists. Four 4to vols. Illustrated with over two thousand original engravings. Vols. I, II. and III.

The Editor, Prof. L. H. Bailey, whose work at Cornell University and as author and authority upon horticultural subjects has made him world-famous, has been gathering material for this Cyclopedia for many years. He has enlisted the co-operation of men of attainments, either in science or practice, everywhere, and the Cyclopedia has the unique distinction of presenting for the first time, in a carefully arranged and perfectly accessible form, the best knowledge of the best specialists in America upon gardening, fruit-growing, vegetable culture, forestry and the like, as well as exact botanical information. It is all fresh, and not a rehash of old material. No precedent has been followed; the work is upon its own original plan.

Its pictorial character is likewise notable. There are over two thousand illustrations, all made expressly for this work, either from accurate photographs or from the specimens. These illustrations have been drawn by competent horticultural artists, in nearly every case under the eye of the editor, or with the supervision of some one of the sub-editors.

The Amateur's Practical Garden Book. By C. E. Hunn, Gardener to the Horticultural Department of Cornell University, and L. H. Bailey. 250 pp. Illustrated. American Gardening, New York. This is the latest issue of the Garden-Craft series. It is the book for the busy man or woman who wants the most direct practical information as to just how to plant, prune, train and to care for all common flowers, fruits, vegetables, ornamental bushes and trees. It has articles on the making of lawns, borders, spraying, fertilizers, manures, lists of plants for particular purposes, hot-beds, window gardening, etc. It is all arranged alphabetically, like a miniature cyclopedia.

Hedges, Windbreaks, Shelters and Line Fences. By E. P. Powell. Illustrated, 140 pages, 12mo. Cloth. American Gardening, New York. A treatise on the planting, growth and management of hedge plants for country and suburban homes. It gives accurate directions concerning hedges; how to plant and how to treat them; and especially concerning windbreaks and shelters. It includes the whole art of making a delightful home, giving directions for nooks and balconies for bird culture and also for human comfort.

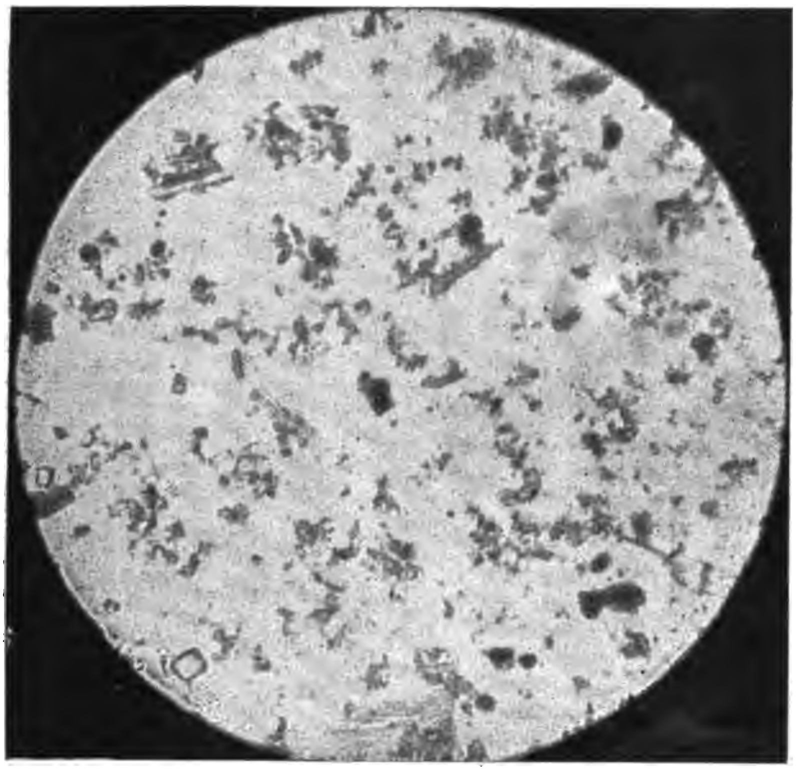
Alumn Baking Powder Under the Microscope.

The report of the Connecticut Experiment Station just issued, contains a somewhat startling arraignment of the alum baking powders. Of the fifteen brands analyzed, about every imaginaable adulteration was discovered, varying from sulphuric acid (22 per cent) to ground rock!

Alum itself is unhealthful and therefore objectionable. The alum powders must be indeed bad when to the objectionable alum are added still further adulterants, so reprehensible as to provoke special condemnation from the health officials. This only goes to show the danger of using any of the cheap grades of baking powder. They are put on the market by small concerns who have no reputation to lose and care nothing for the public health. The cream of tartar powders, on the other hand, though costing a little more, are made by large and responsible firms who have too much at stake, even were they so inclined, to father anything but a chemically pure article.

The family physician may not find it practicable to overhaul the larders of all his patients, but the knowledge he possesses of the dangerous character of alum powders ought to be communicated, paricularly in cases where digestive and simlar troubles are indicated. There are two or three cream of tartar baking powders whose names have become "household words" and from them the housewife may afely make her selection.

The New York health authorities, we note, have recently seized and destroyed several tons of alum baking powders found in one of the large department stores of this city. This is a move in the right direction.



REPRODUCTION FROM A PHOTOGRAPH OF ALUM BAKING POWDER, MAGNIFIED.

New Deadly Organism.

In the New York Zoological Park, three orangoutangs and one chimpanzee have recently died from a microscopic organism introduced in the park by the giant tortoises from Galapagos Islands, having been placed in a cage in the center of the inclosure that held the big turtles, and reaching out between the bars and picking up wisps of straw, over which the turtles had crawled and chewing them. The organism, which is the lowest order of infusoria, is known as the Balantidium coli.

It is something like an apple seed in in form, with rapid motility. It burrows through the mucous membrane into the larger intestine and causes ulcers. The same organism caused the death of a number of soldiers in the Philippines. With men it sometimes takes a year or two for the disease to prove fatal.

Education in Spain.

Consul Ridgely reports from Malaga, January 16, 1902, that according to the statistical annual of the Council of Public Instruction, just published, there are 25.340 public schools in the forty-nine provinces of Spain, 9.313 for boys, 7,612 for girls, and 8,423 for children of both sexes.

A Smoke Alarm.

Animal fibre that has been treated with soda solution is found by O. Freymann and Charles Tolman to have the curious property of elongating on exposure to smoke. The treatment consists in boiling the fibre—which may be silk or horsehair —for 20 minutes in a 6 to 10 per cent. solution of commercial soda, and then drying while slightly stretched in a tube from which the air has been exhausted. Just what change is produced is not understood. The presence of smoke is found to have invariable effect, however, and a smoke-detector alarm has been patented which is made to act through the closing of an electric circuit by the lengthening of the fibre.

Wireless Telephoning from Balloon.

At a recent meeting of the French Society of Aërial Navigation, M. W. de Fonville exhibited an apparatus, invented by M. Ducretet, enabling aëronauts to remain in communication in the air. The invention is a wireless telephone, which is carried in the balloon, and which dispenses with the need of a wire connecting the aëronaut with those on the earth. As an illustration of its practical use it is pointed out that, if the instrument were fitted to a steerable balloon, the Scientific Commission on the Eiffel Tower would be able to transmit orders to the aëronaut, directing him to go east or west, to rise or descend, at pleasure.

Autos on the Sahara Desert.

The French government is experimenting with gasoline autos in the Sahara, for carrying the mails and supplies between the different oases. A gasoline auto can go 500 miles without a renewal of supplies. The desert makes good automobile traveling and 20 miles an hour is accomplished. The Sahara has never been fully explored, and France hopes to yet make a good deal of this forsaken region.

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Discoveries in Greece.

The recent discoveries in Greece and the islands adjacent have been so numerous that a proper understanding of their general significance has been rendered difficult. Interest is at present centered in the islands of Leucas and Ithaca, because of discoveries which may shed a new light upon the home and surroundings of Odysseus. From various parts of the country come reports of discoveries, although in many cases these are mere fabrications, and, when they are not, considerable difficulty is found in securing Government possession.

A rather important field is being developed on the Island of Crete. Seven tombs have been unearthed within the last three months, bearing every evidence of Myceanic origin and containing skeletons of men and women, marble statues, gold rings and bracelets, and various other ornaments and figures. One held a very remarkable carving in carnelian, rectangular in form, but slightly rounded on its long sides, and surmounted by two striking figures. The one represents a man in a kneeling position grappling a huge bull by the horns; the more remarkable of the two, however, is the figure of the Babylonian demon of the storm, the monstrous Typhon or Typhoon, after Assyro-Babylonian art, standing, with open mouth, upon its hind feet and holding aloft between its fore-feet the figure of an animal. Upon its back it bears the heavy, fringed tunic of the Babylonian kings. This figure is considered of a high order of workmanship and very valuable.

Among other objects of interest found in these tombs were an earthen vase in the form of a wine pourer, the neck and mouth representing the head of a bird; a small bronze mirror; rectangular blocks of ivory surmounted by figures of mariners; and light, golden beads or bulbs, used as the medial pendants for necklaces and collars. The bodies discovered in each of the tombs are in a poor state of preservation, in most cases only the teeth remaining intact.

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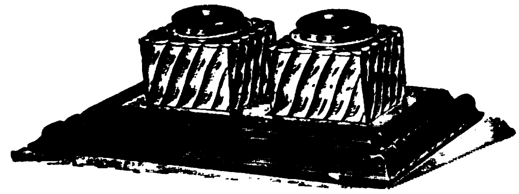

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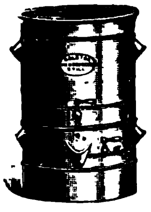

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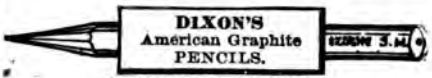

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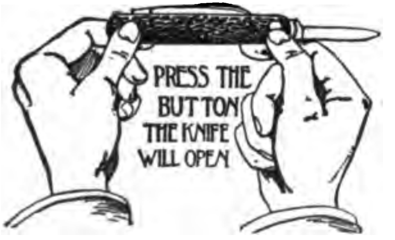

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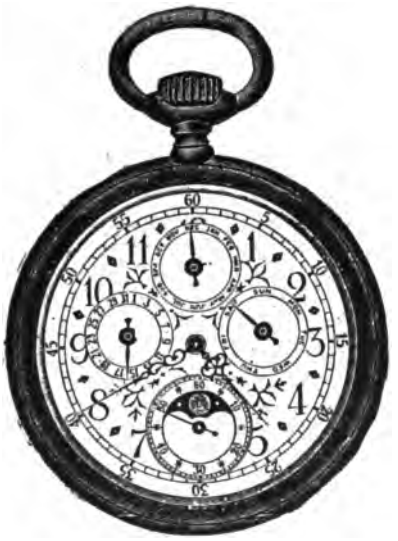

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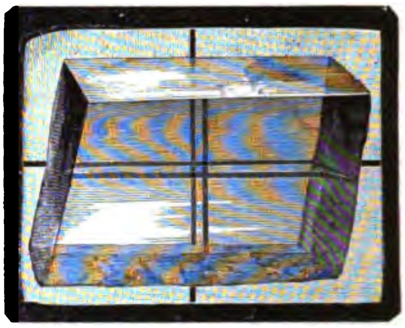

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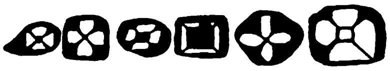

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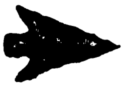

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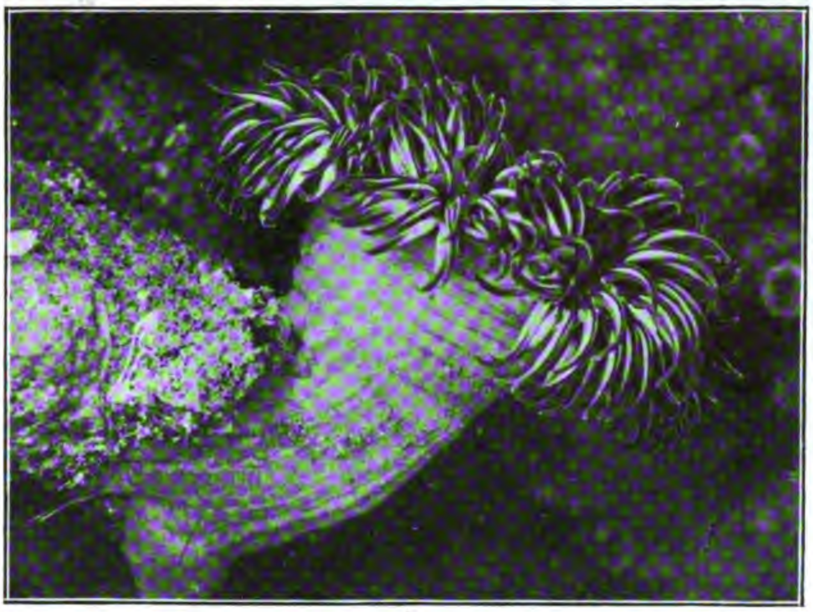


Photo from life under water. EPICYSTIS OSCULIFERA (SIDE VIEW).

FLOWERS OF THE BERMUDA SEA

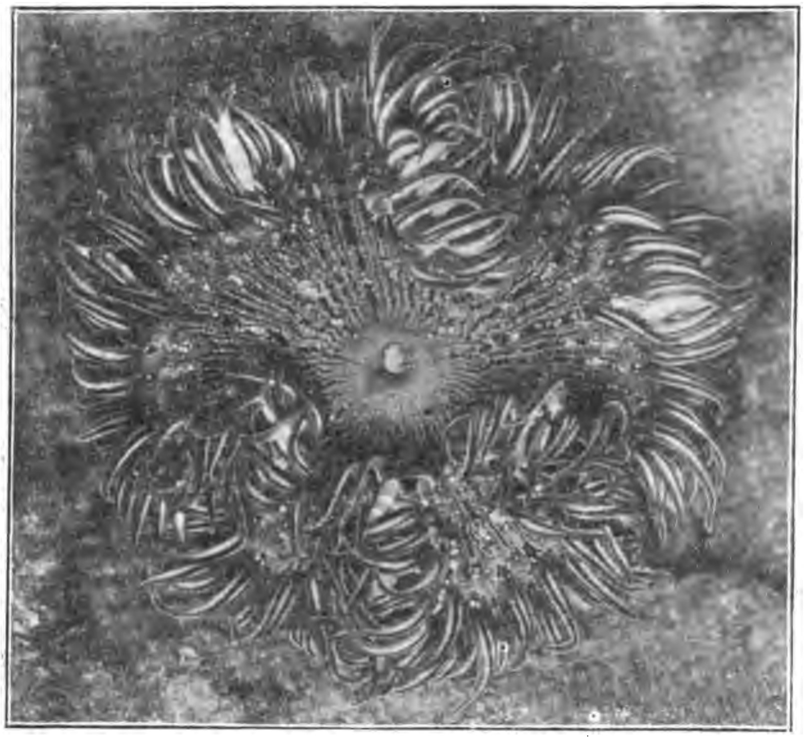
By A. HYATT VERRILL.

AMID the multitude of forms of submarine life, it is hardly surprising that many should remind us more or less strongly of terrestial creatures. The Pycnogonids look decidedly like spiders; the naked-molluscs may be likened to slugs; fish with wing-like fins flit about like birds in our atmosphere, while worms, annelids, planarians and nemerteans, crawl among weeds and plants as do caterpillars on land Scattered among this mass of vegetable and animal life are many handsome forms of gorgeous colors, which to the casual observer, might readily be mistaken for bright-hued flowers. These sea-flowers, however, are in reality voracious animals known as actinias, or sea-anemones. Although of almost innumerable shapes, sizes and colors, all actinias are alike in some respects. They all possess more or less cylindrical bodies, or stems, crowned with numerous tentacles, or petal-like organs, and all have enormous, elastic stomachs, which can be turned inside out at will. In fact, the stomach can be said to form the most important portion of the sea-anemone's anatomy and is little more than a huge sack or bag with the open end or mouth in the centre of the disk between the tentacles. These tentacles are very sensitive and in the majority of cases retractile, and serve to seize and hold the actinias' prey, as well as to warn the creature of impending danger.

Many of the anemones are provided with minute, thread-like and stinging organs, which can be projected with sufficient force to penetrate the skin of passing fish or other small animals, thus stupefying or even killing them: and one species, the Lebrunia danae, of Bermuda, also of the West Indies, has these tiny lasso-like stings developed to such a degree that even man is affected by them, and on several occasions I have suffered severely from too rough handling of these fellows. They are, however, very large, often expanding a foot or more in diameter, so that the powerful character of their poison is not so wonderful as it would appear to a person familiar only with our small, native species. Although the majority of actinias are fond of shady crevices of rocky shores, there are many species specialized for entirely different modes of life.

The members of the genus Phellia are queer, bottle-shaped creatures with short, blunt tentacles, and dwell in sand or mud between or under stones. Here, with only their disk and expanded tentacles above the surface, they are comparatively well concealed, although the exposed portions are handsomely marked with rusty-red, white and black. At the first sign of approaching danger, they instantly contract and draw themselves down out of sight. The genus Cerianthus on the other hand, although ordinarily living "up to the neck" in mud, have the remarkable power of swimming freely about by forcibly expanding and contracting the long and tapering body. Some of the deep-sea species are provided with pockets in the sides of the body wherein the young are placed and live happily until old enough to shift for themselves, while in others the young grow to a respectable size within the body of the parent.

Almost every conceivable color and tint occurs among these beautiful creatures and in fact bright colors seem to be the rule, evidently acting as a danger flag to voracious fish which might otherwise devour the actinias with dire results to both the eater and the eaten. Our native species are of comparatively dull colors, pink, olive, yellow or white predominating, but as we approach the tropics with their wealth of genera and species, they increase in size and beauty. Condylactis passiflora, one of the commonest of West Indian and Bermudian anemones is truly a most gorgeous creature and rivals any flower of earth. Of large size,—from a foot to two feet in diameter,—with long, gracefully-tapered tentacles, its form and size alone would attract attention anywhere. Add to this, a stout body of brilliant carmine, vermillion, or orange, and paint the tentacles with fine alternating lines of brown or green and white, and to finish off the whole, tip each tentacle with dazzling mauve or azure, and you may have some idea of how these magnificent sea-flowers appear in life.

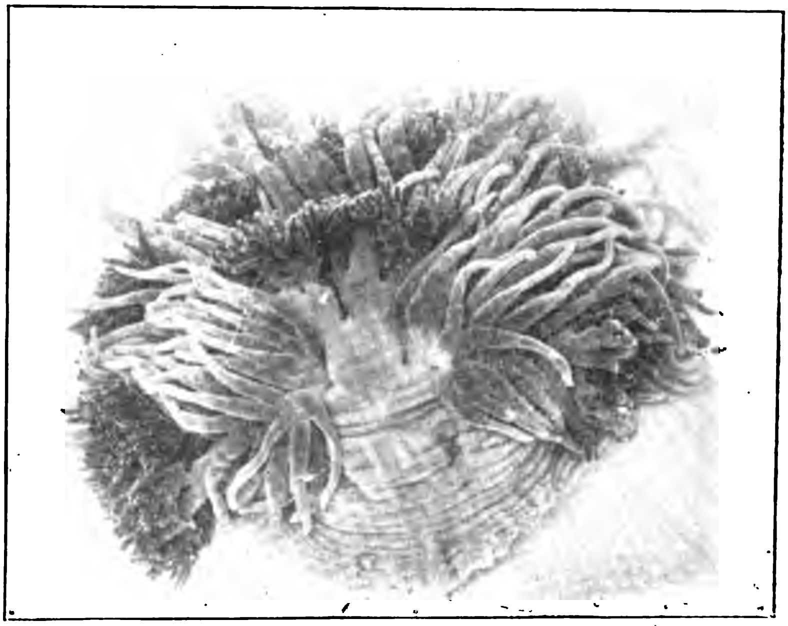


EPICYSTIS OSCULIFERA (TOP VIEW).

In the same situations with these handsome fellows, and equalling them in size, are found the two species Epicystis osculifera, and crucifera. In form these are even more beautiful than passiflora, for the disk, which is very wide and thin and projects beyond the circumference of the body in expansion, is constantly thrown into the most beautiful curves and scallops. Around the edge of this fluted disk, which is pale pink marbled and spotted with lavender, green, white and red, are the three hundred or more tentacles, rich green in color and ribbed with ivory-white and striped with amethyst. Below this myriad of tentacles, the body is a deep, rich crimson, fading towards the base to palest rose, the crimson running down through the paler ground color in broad streaks and dashes. Over the upper portion of the body are scattered numerous warty protuberances, a deep violet in color.

Unfortunately much of this beauty is lost to the observer, for in life these beautiful species dwell in deep cracks or crevices of the rocks and seldom extend more than the disk above their surroundings. Another Bermudian species, Actinia bermudensis, is short and stout and is a most intense vermillion or scarlet in color, with the exception of a row of azure-blue, eye-like organs around the upper edge of the stem.

Closely allied to the true actinias and forming a connecting link between them and the corals are the species of Zoanthus, anemone-like creatures of varied form and hue, spreading from a common base, and, in localities where they occur, fairly carpeting the ocean's bed with their round, tentacle fringed disks of red, brown, green, violet, or yellow. In many places in Bermuda waters these sea-flowers, with a host of others equally beautiful and large, fairly crowd each other upon the rocks and dead coral, and the beholder looking down through the crystalline-clear water, can readily imagine that the myriad of gloriously tinted beings are, in reality, flowers in some mermaid's garden.



LEBRUNIA DANAE

* * *

Santos-Dumont's Narrow Escape.

Santos-Dumont, the intrepid Brazilian navigator, who has been carrying on his experiments at the little principality of Monaco, on the Mediterranean coast of France, had what was very near a fatal mishap not long ago.

He had made a number of very successful flights, of half an hour or more each, but this time the crowds that were watching the ascent saw at once that something was wrong. The airship dived and pitched like a kite without a tail, but Santos-Dumont kept it pointed resolutely upward. It proved that the guide-rope had got caught in the propeller, which made the craft unmanageable. The aeronaut finally saw that something desperate had to be done and he jerked a rope that was arranged to open a seam in the balloon part of the airship, thus letting the gas out and making the machine descend.

Meantime there was the greatest excitement among the people below. The airship was out over the water, and a number of yachts were following it in order to rescue the balloonist. Santos-Dumont, still clinging to the disabled airship, dropped into the water and came near being drowned, but was taken out by the Prince of Monaco on his yacht. The airship was wrecked. the motor going to the bottom, only the balloon part being saved.

Santos-Dumont is making an airship for use next summer that will be supplied with two petroleum motors of 45 horse-power each, in place of the single 16-horse motor of his old machine. It will be the seventh and the largest balloon he has had.

Animal Life

KING BIRDS.

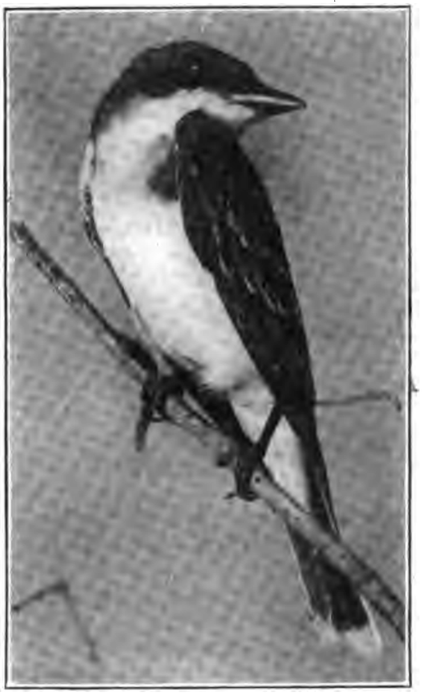
BY DR. R. W. SHUFELDT.

The birds we call Kingbirds in this country, all belong to a group of songless Passeres called the Clamatores. We have as the type of this group the Kingbird, a species found all over North America, from the British Provinces south into Mexico and to South America. It has as yet, I believe, not been taken in either Arizona or Mexico. The genus to which this bird belongs is the genus Tyrannus, and it is specifically known as T. tyrannus. When Wilson wrote his ornithology during the first part of the last century, it was, I believe, the only kingbird known to him, and he called it also the Tyrant Flycatcher, or technically Muscicapa tyrannus; while by Linnæus it was supposed to be some kind of a shrike (Lanius)! Over a good part of the United States, the species is also known as the "Bee Martin," as at certain seasons he is very fond of being in the vicinity of the bee-hives, and feeding on the bees, though it is said he only selects the drones.

In some of the middle Atlantic states the Kingbird is likewise known as the Field Martin, from the facts that he is chiefly to be observed out in the open fields, and does not inhabit the shady woods like some related flycatchers. As to the epithet "tyrant" that has clung to him so long and so well, Wilson has said, "I am not altogether so well satisfied with; some, however, may think the two terms pretty nearly synonymous,"—that is, of course, taking into consideration his other common name of Kingbird, and it tends to show in what poor esteem Wilson held the average king. "The trivial name, King, as well as Tyrant, has been bestowed on this bird for its extraordinary behavior," he says, 'and the authority it assumes over all others during the time of breeding."

In the last edition of the A. O. U. "Check List" of North American Birds, we find a number of Kingbirds enumerated in addition to the common form mentioned above. There is the Gray Kingbird (T. dominicensis) that is found in several of the south Atlantic states as South Carolina, Georgia, and Florida. Next is Couch's Kingbird (T. melancholicus couchii), of the southern border of the United States (Texas), and the Arkansas Kingbird (T. verticalis), of the western parts of the United States, from the plains to the Pacific. This species has likewise occurred accidentally in Maryland, New Jersey, New York, and even Maine. Finally, there is Cassin's Kingbird (T. vociferans), also a western species occurring from southern Wyoming, eastern Colorado, New Mexico, Arizona, western Texas and southern California, thence southward into Guatemala.

Wilson's account of the eastern Kingbird is one of the best that has ever been published. Little or nothing has been added to it by ornithological writers since his time. He was very fond of presenting short "poetical epitomes' of the life-histories of such American birds as he was especially fond of, or admired. One of the longest of these he ever wrote was on the Kingbird, and I have read it through many times in the last twenty-five years, and am very likely to do so again. Were it not so long, I would like it to be printed with this article, if for no other reason than to help keep alive the poetical side of ornithology, to offset at least a little of the cut and dried side of the subject that is so voluminously being poured forth in print in this day —— like Shufeldt's osteological papers, I hear some one say.



THE KINGBIRD (T. TYRANNUS).
Photo from life by the author.

A number of years ago, among other articles, I contributed the one on the "Kingbird" to the work written by Prof. Alfred Newton, F.R.S., and entitled "A Dictionary of Birds (Adam and Charles Black, London, 1893)." In speaking of these birds there, I said that "many of the Tyrannidæ have habits in common, while the king-birds have others that are essentially peculiar to the genus. To present an account of the most characteristic of these, we may choose the eastern form as an example, and the extraordinary behavior of his bird during the entire breeding season is the most remarkable trait to be noted. From the very day the building of the nest is first started, until the time when the young finally shift for themselves, the male of this species gives constant battle, without discrimination, to every bird that passes within range of his sitting mate and the precious contents of his nest."

These sallies are almost invariably successful, and Wilson writes that "Hawks and Crows, the Bald Eagle, and the great Black Eagle, all equally dread an encounter with this dauntless little champion, who, as soon as he perceives one of these last approaching, launches into the air to meet him, mounts to a considerable height above him, and darts down on his back, sometimes fixing there to the great annoyance of his sovereign, who, if no convenient retreat or resting place be near, endeavors by various evolutions to rid himself of his merciless adversary. But the Kingbird is not so easily dismounted. He teases the eagle incessantly, sweeps upon him from right to left, remounts, that he may descend on his back with greater violence; all the while keeping up a shrill and rapid twittering; and continuing the attack sometimes for more than a mile, till he is relieved by some other of his tribe equally eager for the contest."

A number of years ago a very fine living specimen of the Kingbird came into my possession It was a "bird-of-the-year," and therefore in what we call subadult plumage. He was very beautiful nevertheless, and by methods I have abundantly described elsewhere, I secured an excellent photograph of him, a reproduction of which illustrates the present article. It was taken about natural size, and he escaped to the fields as soon as the sitting was over with. In appearance the Kingbird is a species of plain plumage, and the sexes are nearly alike. Above he is black, most intense on the crown, where we also find a semi-concealed, longitudinal, median dash of flame-colored feathers, capable of erection, as a crest, with the rest of the plumage on the top of the head. Below he is nearly white, and his black tail is strongly tipped with the same. Laterally, the white of the breast is shaded with plumbeous, and his wings are dusky, bordered with whitish. He has a peculiar, wavering flight, something after the manner of certain small hawks; while song he has none, possessing only the twittering note to which allusion has already been made, and which at times is very shrill, being heard at some considerable distance.

This bird builds a large, compact nest of twigs, lined with fine grass, and other materials interspersed throughout, as tow and fine roots. The place chosen may be quite conspicuous, as in a low tree near the wayside, or without regard to concealment in the middle of the orchard, as in an apple tree. The eggs are extremely beautiful, usually numbering from four to six, being of a creamy white, boldly dashed with elegant blotches of various shades of brown, which chiefly encircle the larger end.

The Kingbird is wonderfully useful to the farmer, as it destroys any number of noxious insects during the course of the season, that are highly injurious to his crops. This being the case, the species should be protected, and not in hundreds of instances be shot down by unthinking farm hands, simply for the fact that he occasionally regales himself on a few of the denizens of the bee hive. It has been stated that the kingbird is also very fond of certain berries, and particularly blackberries, but I have never personally noted this fact.

Wilson records an interesting account of albinism in the case of a kingbird in his life-history of the species. He says, "A few days ago, I shot one of these birds, the whole plumage of which was nearly white, or a little inclining to a cream color; it was a bird of the present year, and could not be more than a month old. This appeared also to have been its original color, as it issued from its egg. The skin was yellowish-white; the eye much lighter than usual; the legs and bill blue. It was plump, and seemingly in good order. I presented it to Mr. Peale" Then he gives various other instances of albinism among birds,—and he must have run across an unusually large number in his experiences,—terminating the account with some remarks upon albinoes in general, and as evidenced in birds in particular.

Hertzian Waves.

In the Marconi system of telegraphy the electrical impulses known as Hertzian waves are projected into the air through wires held up by tall masts, and are received through similar elevated wires. The receiving apparatus is made possible by the coherer. This is a small tube of metallic filings, which is placed in an electric circuit and becomes a conductor—closing the circuit and permitting the current to give an audible or visible signal—only when acted upon by an impulse from the distant transmitter.

In the new Orling-Armstrong system, the impulses are sent through the earth instead of the air. This removes the necessity of tall masts, and a new receiver is claimed to be effective without expensive apparatus and with currents of very low voltage. An electro-capillary relay supplants the coherer in this receiver. An inverted syphon of mercury has one foot in a vessel of mercury, while the other foot, contracted to a very fine opening, rests in a vessel of dilute acid at considerably lower level, and the action depends upon the fact that the passage of an electric current narrows the mercury column and causes a drop to fall from the lower end of the syphon. This drop gives a signal by closing a relay circuit or in some other way.

Earth telegrams produed by this method, known as the Armorl invention, have been sent 20 miles with a current of only four volts.

DOES HOLDING THE BREATH HYPNOTIZE?

BY EDWARD F. BIGELOW.

Many a country boy has been "initiated" into the so-called art of handling a wasp. By painful experience, and to the great amusement of his companions he has learned the difference between the drones and the wasps with stings, and he has also learned, or at least supposed that he learned, that holding the breath or repeating mystical words had no effect in the matter.

William Hamilton Gibson describes this well known trick as follows:

> "Creep up slyly, hold your open palm within a foot of the insect, and murmur to your inmost self the following brief sentiment, 'Polistes, Polistes, bifrons, proponito faciem,' and wait until the insect turns toward you, which it is more or less certain to do; then, with a quick clutch, grasp your prize. It is not necessary to hold your breath or wet your fingers, as is commonly supposed; the above classic charm will work quite as well without. After holding the insect in the hollow of your hand for a moment, take him boldly between your fingers, roll him, pull him, squeeze him, and twirl him as you will; no amount of abuse will induce him to sting. Perfect faith in the above will enable any one to handle a wasp with impunity.
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> P. S.—I almost forgot to mention that it is always safest to experiment with white-faced wasps, as these are the drones and have no sting."

But one boy didn't so thoroughly learn the trick, as to prevent him from claiming when he became a grown-up and the Commissioner of education, that there is really no trick at all in it. Here's the astonishing claim of William T. Harris in an article "Recollections of a Red Schoolhouse," in a recent number of The Youth's Companion.

> "But there were other survivals of magic of a nature kindred to hypnotism. One of these I shall always remember, because I still retain the power it gave me, and I am not yet able to explain it at all.
>
> On leaving my red schoolhouse to attend a larger one, a white schoolhouse at the central village, I found a number of boys who, when they held their breath, could handle wasps without being stung; not the white-faced variety of wasp, which does not sting, but the stinging ones. It was a tradition in that school that wasps cannot sting a person who holds his breath.
>
> After seeing enough experiments on other boys to give me some confidence, I ventured to handle the vicious insects, and discovered that I, too, could do it without being stung so long as I obeyed the injunction and held my breath; but I had to be very careful in throwing them away, and not begin to breathe before I had freed my hands from them.
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> Strange as this may seem to many, I am reporting it as a fact. It is a power that I verify every year when the opportunity comes. During the past six years I have tried hornets and bumblebees also with nearly as good success. I have learned incidentally of other persons who have and use this means of protection against wasp stings, and I believe it may be used by all who have sufficient self-possession to hold the breath without intermission from beginning to end of the experiment."

Can it be that the Commissioner is right and that generations of boys innumerable have been mistaken, that the victims were victimizers and the laughs are all to be reversed? Let's have the matter settled.

There are other boys that also were pupils at the red schoolhouse, and handled wasps, but to their great regret (the loss was felt most pointedly and keenly then) they had no hypnotic power, and have not acquired it in later years. Will the Commissioner kindly favor members of the red schoolhouse fraternity and others with a public demonstration, at a convenient place, at the proper time? There are those who will gladly assist by furnishing a liberal quantity of wasps, hornets, bumblebees and honey bees, properly caged.

New Locomotive Headlight.

The Chicago, Milwaukee & St. Paul Railroad has just completed a series of satisfactory tests of a new electric headlight which is sufficiently powerful to illuminate the tracks a mile ahead, so that the engineer can see at that distance practically as well as by daylight. During tests photographs of a bridge were taken at a distance of 1,000 yards from the light, and the illumination was so strong that even the insulators on the telegraph poles were distinctly visible, while the brdige itself stood clearly revealed. In construction the lamp is similar to the searchlights employed on warships, and it is of 6,000 candle-power. Electricity is supplied by a small dynamo on the locomotive, which is driven by a steam turbine. In order to properly light curves the lamp is mounted on a pivot, and may be swung to right or left by a lever in the engine cab.

One of the most important arrangements about the new light is what is known as the "auxiliary deflector," by means of which part of the rays are deflected from the track and thrown upward into the sky, showing a glare on a dark night by means of which it was possible to make out the location of the train miles away. The deflector is simply a reflector set at an angle of 45 degrees, and about 40 per cent. of the rays are thrown up against the clouds.

By means of the old headlight no more than 400 feet of track was illuminated in front of the engine. The ordinary passenger train running at the rate of fifty miles an hour needs from 900 to 1,400 feet in which to stop to avojd accident.

A Moth's Knife.

In the Entomologist Mr. F. B. Dodd describes a peculiar instrument by means of which the silk-producing moths of the Australian genus Antheræa cut their way out of their hard cocoons. The instrument "is a short, hard, black, and curved thorn, situated in the thick joints at the base of the fore-wings, one on each side. In a rubbed specimen the thorn is easily discernible; but in a good one it is concealed among the dense scales.

CAUSE OF VARIATION IN SPECIES.

BY W. C. CAHALL, M.D.

Darwin offered pangenesis as simply a working hypothesis, but Weismann professes that nature actually works according to his theory of germ-plasm. According to pangenesis each cell or group of cells of the adult body gives off gemmules, or minute particles representing potentially the cells themselves, and capable of multiplication by division, and segregated from the circulation by the reproductive organs, from whence they may, after union with others, proceed to the evolution of another organism.

But, in order to explain reversion of offspring to characteristics of remote ancestors, it was held that the gemmules could lie dormant for many generations before they developed into the cells, like those from which they were derived. This hypothesis allows the belief in the transmission of acquired characters, and so far as I can judge, Darwin held to this belief to the end.

Weismann brushes aside pangenesis and sets up his Germ-Plasm as an explanation of heredity, variation, atavism, and all the other problems of organic development; its structure is after this manner,—"According to our view, this substance of the multicellular organisms consists of three orders of vital units, the lowest of which is constituted by the *biophors*. In the unicellular forms a more or less polymorphic mass of biophors, having a definite arrangement, constitutes the individual nuclear rods or *idants*, several of which make up the hereditary substance of the nucleus which controls the cells; and similarly in those higher groups of biophors, arranged in a certain order, constitute the primary constituents of the individual cells of the body, and together form the second order of the vital units, the cell determinants, or simply, the determinants. The germ-cell of a species must contain as many determinants as the organism has cells or groups of cells, which are independently variable from the germ onwards, and these determinants must have a definite mutual arrangement in the germ plasm, and must therefore constitute a definitely limited aggregate or higher vital units, the *id*."

According to Weismann, only unicellular organisms are capable of being directly acted upon by external conditions and acquiring new characters which may be transmitted. The multicellular organisms cannot transmit acquired characters because reproduction is solely by means of germ-plasm, which is always a segment of pre-existing germ-plasm, transmitted from parent to offspring without undergoing any modification by any changes which may take place in the body cells themselves. All changes in the germ-plasm take place by external agents acting directly upon the ultimate parts of the germ-plasm itself.

He says, "all new structures are due to variation and frequent multiplication of the determinants. The cause of variation must be due to the direct effect of external influences on the biophors and determinants. It can no longer be doubted that climatic and other external influences are capable of producing permanent variations in species. The origin of a variation is equally independent of selection and of amphimixis, and is due to the constant recurrence of slight inequalities of nutrition in the germ-plasm which affect every determinant in one way or another, the term 'nutrition' being used in its widest sense, so as to include differences in temperature, etc. The sudden appearance of polydactylism and its great tendency to transmissibility can, moreover, be easily understood if we suppose that excessive local nutrition has caused the group of determinants in question to become double. The polymorphism of bees and other animals which form communities, require, however, the assumption of triple or quadruple determinants."

Without stopping to consider the artificial machinery introduced to explain natural phenomena, I shall attempt to measure pangenesis and germ plasm by physics and mathematics.

Let it be understood that, according to these theories, the nucleus of each ovum and of each spermatozoon must contain within itself a complete set of gemmules or of biophors and determinants, representing every cell or group of cells of an entire organism. Darwin, with that broadness of mind characteristic of him, saw this difficulty and frankly stated it. He gave, however, a calculation of his son, Prof. George Darwin, based on an estimate made by Lord Kelvin, which led him to think there was ample room. According to this calculation, a cube of $\frac{1}{10000}$ of an inch of a glass or water must contain between 16 million millions and 131 million million molecules.

Now the only estimate of the dimensions of a molecule given by Lord Kelvin, which I have been able to find, is that given by J. Clark Maxwell in Encyclopædia Britannica, in article "Atom," wherein it is definitely stated that two million molecules of hydrogen arranged side by side would form a line one millimetre long. As there are 25 millimetres in an inch, it would take 50 millions of hydrogen molecules to measure an inch. Of course, this estimate must be considered only a rough approximation, but Loschmidt and Stoney independently arrived at similar conclusions.

According to this estimate, in one linear ten thousandth of an inch there would be five thousand molecules, and in the cube of this dimension there would be the cube of five thousand or one hundred and twenty-five thousand million of molecules, which is an exceedingly smaller estimate than that made by Prof. Darwin; and, since the hydrogen molecule is so much smaller than that of water or glass, the difference is just that much the greater.

Let me make an application of these facts to the human organism. The nucleus of the human spermatozoon is almost exactly the one-ten-thousandth of an inch, cube or diameter. If we knew how many cells or groups of cells there are in the human body, it would be easy to find the number the nucleus must contain. No count has ever been made, not an estimate to my knowledge been attempted. But some counts, which are a part of a modern hospital's routine work, and sufficiently accurate, furnishes us with a basis to approximate the number of body cells.

In an average healthy adult there are from five to seven million red-blood corpuscles in each cubic millimetre of blood, and since there are one thousand cubic millimetres in one cubic centimetre, and there are one thousand cubic centimetres in one litre, and about eight litres of blood in the adult;—therefore $5,000,000 \times 1,000 \times 1,000 \times 8 = 5,000,000 \times 8,000,000 = 40$ million millions of red blood corpuscles in a large man. Since the volume of blood forms about one-tenth of the entire body, the entire number of body cells would reach 400 million million, provided all the body cells were of the same size as the red corpuscles. This, however, is not the case, for few tissue cells are so small as the red corpuscles, nor would it be just to infer that each of these million million cells must have a representative gemmule or biophor, for both Darwin and Weismann claim that whole groups of cells could develop from a single gemmule or biophor. This is true of such cells or the red corpuscles which are free and unattached. But the fixed tissue cells must have each a representative in the ovum or spermatozoon, since hereditary marks, as moles, white locks of hair, peculiar muscular attachments and bony conformations, are reproduced cell for cell.

We must further consider that the red corpuscles constitute but about 45 per cent. of the volume of blood, while practically the tissues drained of blood are entirely composed of cells. On the other hand the size of an organic molecule is vastly larger than one of hydrogen, the smallest known. The hydrogen molecule is composed of two atoms, that of water of three, and that of glass perhaps six or eight, while the molecule of albumen, the nearest to that of living matter, has as many as two hundred and twenty-five ($C_{72}H_{117}N_{18}O_{22}S$), and Darwin and Weismann allow that their gemmules or biophors most likely contain many of these organic molecules.

Furthermore, these gemmules or biophors located in the nucleus must have nutrition, and since they cannot go outside the nucleus after it, food must go into it to them, so that for each gemmule or biophor there must be not less than two molecules of organic matter within the nucleus for each gemmule or biophor at the same time, one the molecule of food going in to replace the molecule of waste going out. Of course to carry on the circulation of food properly there must be within the nucleus many more times than twice the number of molecules of food to each gemmule or biophor. Finally, referring to the quotations from Weismann above, to explain polydactylism and at avism, there are required additional sets of biophors, duplicating themselves twice or many times over.

So when one attempts to pack away into this spermatozoon nucleus, about the $\frac{1}{10000}$ of an inch cube, and capable of holding, according to Lord Kelvin's estimate, only 125,000 million hydrogen molecules, these 400 million millions, more or less, of gemmules or biophors, with their duplicates, each consisting of many organic molecules, and each molecule many times larger than the hydrogen molecule, accompanied by the necessary number of food molecules, the result, if it could be viewed under the microscope, must seem a veritable cornucopia.

No wonder that Weismann himself after elaborating this theory, feels impelled to write, "Thus an ever increasing complexity of substance which renders the repetition of the organism possible, is gradually produced in the phylogeny of living beings, and eventually reaches so high a degree that it is difficult to believe that such an infinite complexity of structure can actually exist in particles so minute." Nature ordinarily works more simply than this.

Turning from these highly speculative theories to what we actually know, we will find the general belief among microscopists is that the *cell* is the ultimate basis of life, and of the cell the nucleus is the vital and active part. The nucleus is composed of a complex and highly organized substance, called idioplasm by Nägeli, a term generally used by microscopists. This substance, constituting the chromosomes of the nucleus, determines not only the character of the cell, but also of all the cells which arises from it.

The cell functions secretes, excretes, remembers, reproduces itself, lives and dies as an entity and not as a colony of life units.

This leads up to the statement, just here, of the first step in the cause of variation, as I see it; namely, the cell is subject to the same formating forces, heredity and environment, which guide the development of all other living bodies, and therefore is subject to the same sharp "struggle for existence."

Weismann himself, while denying the transmission of acquired characters in multicellular organisms, frankly concedes the occurrence in unicellular, and that variation among unicellular organisms can take place only by means of the inheritance of acquired characters. While he did not contemplate such an inference to be drawn from his words, indeed would probably combat it, it is clear in my mind that every active cell in a developing organism responds to outside stimuli in precisely a similar manner to unicellular organisms, and that logically there can be no reason why they cannot acquire new characters, and transmit them to their immediate descendants.

If such be the case, then the cause of variation in species need not be far to seek. What Weismann claims for his biophors and determinants may be with more certainty claimed for the cells themselves. He says, "the origin of a variation is equally independent of selection and of amphimixis, and it is due to the constant recurrence of slight inequalities of nutrition in the germ-plasm which affect every determinant in one way or another, . . . the term 'nutrition' being used in its widest sense, so as to include differences in temperature, etc." He does not explain how these biophors, lying million times a million within the $\frac{1}{10000}$ of an inch cube, can possibly have perceptible inequalities of temperature, etc.

There are some observations and experiments which seem to prove that the power to vary lies not in the isolated germ-plasm, but throughout the entire organism, that the cells which go to make up tissues and organs, undergo variation from inequalities of nutrition during development, that they are not predestined to be such from the first stage of ovum development, but that each cell contains within the idioplasm of its nucleus the capability of being something else, should environment have been different. Galeotti made the discovery that by subjecting the epithelial cells of salamanders to dilute solutions of such drugs as quinine, cocaine and antipyrin, an asymmetrical mitosis, exactly like that in carcinoma, may be artificially produced.

Wilson says that if one of the infusorian Oxytricha be cut into two pieces, the subsequent behavior of the two fragments depends on the presence or absence of the nucleus or a nuclear fragment. The nucleated fragments quickly heal the wound, regenerate the missing portions, and thus produces a perfect animal.

Lille has found that a stentor may by shaking be broken into fragments of all sizes, and that nucleated fragments as small as $\frac{1}{27}$ the entire animal are capable of complete regeneration.

Roux succeeded in killing, by means of a hot needle, one of the blastomeres of frog's egg, at the two-cell stage, and found that the unharmed half developed into a half larva, and later grew into a complete embryo. This beautiful experiment has since been confirmed by others in similar manner upon other animals. Wilson found it true in the Amphioxus, with this difference,—that the living segment of the blastomere develops from the start like a perfect ovum.

Driesch isolated the blastomeres of sea-urchin eggs at the two-cell and four-cell stage, and found that they segment into a perfect dwarf of half or quarter the normal size. Zoja carried the experiment to even the eight-cell and sixteen-cell period, and obtained perfect embryos of dwarf dimensions, the one-eighth and one-sixteenth of the normal size.

Hertwig, in view of these and other experiments, declared that there is a formative power resident in the entire mass of the organism which causes it to develop as a whole, and that the several parts develop as part of the whole. He says, "According to my conception, each of the first two blastomeres contains the formative and differentiating forces not simply for the production of a half body, but for the entire organism; the left blastomere develops into the left half of the body only, because it is placed in relation to a right blastomere." This agrees with the conclusions of Driesch, that the nuclei of all the cells are equivalent and all contain the same idioplasm equally distributed.

Oscar Schultze has made the important discovery that if the egg, when in the two-cell stage, be turned upside down, a perfect embryo could arise from each half, instead of a half-embryo, as in the usual course, showing clearly that the egg does not divide according to any pre-destined manner, as would result if under gemmule or biophor direction, but simply as the result of changed metabolism.

According to some experiments by Pouchet and Chabry, and later by Herbst, it was found that profound changes in the developing embryo followed even slight changes in the environment. It was shown that if the embryos of sea-urchins were made to grow in sea water containing but a slight excess of potassium chlorid, the larva not only does not develop its calcareous skeleton, but its ciliated arms as well, the result being a larva which approaches in appearance an entirely different species. Herbst also found that should the sea-water contain but a slight percentage of lithium chlorid, the blastula evaginates to form an hour-glass-shaped larva instead of the typical invaginated gastrula.

Geoffroy Saint-Hilaire in his work on Monstrosities is authority for the statement that the eggs of the fowl, if shaken, placed upright, perforated, etc., produce monstrous chickens. Here the variation from the type arose not from any possible change in the préformed germ-plasm of the parents, but solely by a rearrangement of the nutritive elements of the egg, and an alteration in the metabolism of the cells.

Indeed there are many experiments which go to prove that even the mature organism may be profoundly altered by environment.

Chas. Darwin, in his Animal and Plants under Domestication, states that the Indians along the Amazon, by feeding the common green parrot upon the fat of large siluroid fishes, produce a beautifully variegated plumage of red and green feathers, and the natives of the Malay archipelago in a similar manner alter the color of another parrot, the Lorius garrulus Lin., and produce the Lori rajah or King Lory.

Had nature provided an uninterrupted diet of such food, a new variety of parrots must have arisen, entirely by reason of the reaction of body cells without reference whatever to any influence of germ-cells, just as minute alterations in the saline constituents of sea-water may have led to the appearance of entirely new varieties of species.

Wilson, in The Cell in Development and Inheritance, says, "Though the tissue cells are often apparently separated from one another by a non-living intercellular substance, which may appear in the form of solid walls, it is by no means certain that their organic continuity is thus actually served; many cases are known in which division of the nucleus is not followed by division of the cell-body, so that multinuclear cells or *syncytia* are thus formed, consisting of a continous mass of protoplasm through which the nuclei are scattered. Heitzmann long since contended, though on insufficient evidence, that division is incomplete in nearly all forms of tissue, and that even when cell-walls are formed they are traversed by strands of protoplasm, by means of which the cell bodies remain in organic continuity. The whole body was thus conceived by him as a *syncitium*, the cells being no more than nodal points in a general reticulum, and the body forming a continuous protoplasmic mass. This interesting view, long received with scepticism has been in a measure sustained by later researches, though it still remains *sub judice*.

Tangl, Gardiner, and many later observers have shown that the cell-walls of many plant-tissues are traversed by delicate intercellular bridges, and similar bridges have been conclusively demonstrated by Bizzozers, Retzius, Fleming, Pfitzner, and many others in the case of animal epithelial cells. The same has been asserted to be the case with the smooth muscle-fibres, with cartilage cells and connective tissue cells, and in a few cases with nerve cells. Paladino and Retzius have endeavored to show further, that the follicle-cells of the ovary are connected by protoplasmic bridges not only with one another, but also with the ovum, a conclusion, which, if established by further research, will be of the greatest possible interest."

Should this be found true, then Weismann will have the ground cut from under his feet, for with the fact once established that the ovum is connected by protoplasmic threads with the body-tissues and cells of the parent, all impressions, such as hypertrophy or atrophy of organs, the result of use and disuse, within the parent, must have a direct influence upon the nuclear element of the ovum, and therefore acquired characters *may* be inherited.

To explain the power which some animals of low order have of reproducing mutilated organs, such as the lobster in restoring a lost leg, Weismann is under the necessity of supposing a complete set of biophors and determinants for each organ the animal may lose, in addition to the great complexity of sets occupying the ovum. But upon the assumption that the idioplasm of all the cells is identical, but modified by the adaptation of the cells to various tissues, it is a simple enough process for the idioplasm of the cells in the neighborhood of the mutilation to reproduce the lost part. The idioplasm being identical originally, it is therefore capable of producing all forms of tissue; the only condition being that the cells shall not have been differentiated too far from the original germ layer.

And here may be found the reason why the animals capable of restoring lost organs are confined to the lower orders, where the differentiation has not been carried out so elaborately as in the higher. Just what happens in the lower orders must happen to the embryo of the higher. Reparative processes are frequently attempted in the early embryo which would be impossible in the adult, and the production of monstrosities, widely as they diverge as end products of development from the normal adult, may be produced by a very slight variation of the elementary cells of the early embryo.

This variation may be brought about by very slight alterations of the environment, it might be simply a new chemical stimulant, such as leads to such profound changes in the sea-urchin, or the increase of nutrition of one part over another by simply change of posture, as in the eggs turned upside down. An increased growth of a few cells in the early stages of embryonic evolution will give them such a start in the race of development that the organs which develop from them will vary so widely from the type that a new species may at once be launched upon its career. It has become almost a proverb among scientists that nature makes no leaps, but from reasons and facts given above, I prefer to differ from this belief, and to stand beside old Geoffroy Saint-Hilaire, who thought that variations did not always proceed by slight and insignificant steps, but that transition may take place by leaps without necessitating intermediate forms, and that these always occurred not in the adult but in the embryo.

I see no biological or physiological objections to a belief in the sudden appearance of a species, even widely different and distinct from that from which it sprang. To take an extreme case, if man had his origin from one of the anthropoid apes, he may have been born a human being, without any intermediary, half-man, half-ape parent. Indeed, this explains, what has been a stumbling block to many evolutionists, why certain species stand isolated, with no fossil remains as evidence of the missing link.

There is another cause of variation which I have not seen offered elsewhere, and in fact it could not have been stated except within the past few years, since the facts upon which it rests have only recently been discovered. This is the exquisite balance between the various parts and organs of the human body. The slightest variation in the regular development of certain tissues or organs produce the most astonishing changes in distant organs, and were the facts not so firmly established it would be difficult to believe that upon so slight modification in the embryonic development of one small gland, such profound and gross deviations of growth of the entire organism could take place.

For instance: within the past five years, much has been learned about the uses of the ductless glands upon the metabolism and growth of the human body, and it has been clearly demonstrated that the presence or absence in the blood of the most minute traces of certain secretions manufactured in one of these insignificant glands, means all the difference between a sane, alert and normal child and a misshapened, lolling idiot.

It has also been shown, quite recently, with many cases cited in proof, that according to the state of hypertrophy or atrophy of a very small protuberance upon the base of the brain, called the pituitary body, the child was destined to develop into a giant or a dwarf. Thus disease performs experiments upon the human body, confirming those of Roux and Herbst upon lower organisms, proving that great changes in the growing embryo follow slight changes in environment.

Reciprocity with Cuba.

The policy of delay enacted at our national capitol in regard to our relations with Cuba is much to be regretted. Aside from our moral obligation to make the revival of the sugar industry in Cuba profitable by allowing Cuban sugar to enter our ports at a much reduced rate of duty, common "horse sense" dictates that we should enter into reciprocal relation with these people.

The beet sugar industry of this country is so small that its production is but a very small percentage of the sugar we use, and by their own admission a reduction in tariff would not affect them, except to cut down an inordinate gain to a just profit. Neither would the cane sugar of our southern states be injuriously affected by the proposed reduction on the tariff on Cuban sugar.

On the other hand, Cuba is our natural market, and at one time we sold them many millions of dollars worth of goods each year. A large portion of this trade is now in the hands of the Germans, but if we renew the tariff relations with the island that once existed, this trade would naturally come back to us.

Plant Life

FRESH WATER ALGÆ.

BY F. R. MILLER.

The bottom of slow flowing streams is frequently seen to be covered with a substance of a dark bluish-green color. If we examine some of this bluish-green substance under the microscope, we will observe a large number of unbranched filaments, one of which is shown in Fig. 1. On looking carefully at these filaments, one can readily make out that many are undergoing slow back-and-forth movements. These back-and-forth movements have given the name of Oscillaria to this plant.

Water-plants, particulary Charas, are frequently seen to be covered with little globular, gelatinous masses. These masses are usually different species of Rivularia and consist of a large number of radiating filaments, a few of which are shown quite highly magnified in Fig. 2. Each filament is seen to terminate in a stiff hair-like bristle, and the whole plant is frequently impregnated with calcium carbonate, which renders it very hard and stiff to the touch. A small piece of Tolypothrix, a genus somewhat resembling Oscillaria in appearance and habitat, is shown in Fig. 3.

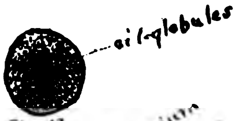


Fig. 13.

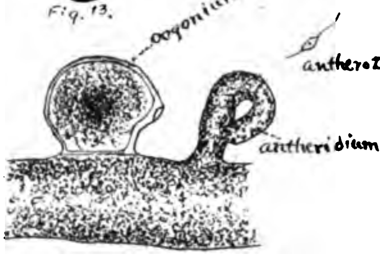


Fig. 10.

Fig. 12.

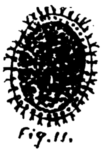


Fig. 11.

Fig. 14

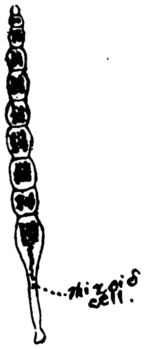


Fig. 8.

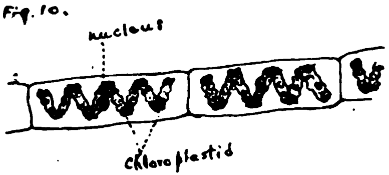


Fig. 4

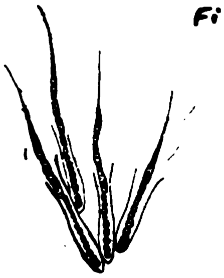


Fig. 2.

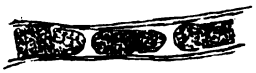


Fig. 3.

Owing to their extremely general occurrence, Spirogyra and Zygnema are probably the best known of all the fresh-water algæ. Although presenting a rather disgusting, scum-like appearance on the surface of stagnant water, they are of unexpected beauty when seen under the microscope. Spirogyra, which is shown in Fig. 4, is seen to be composed of a row of elongated cells placed end to end. Each of these cells contains a spirally-coiled chloropastid and a nucleus in the middle.

In Zygnema, Fig. 5, the chloroplastid is dumb-bell shaped, not spirally-coiled as in Spirogyra. Under unfavorable conditions of heat or cold, Spirogyra and Zygnema are seen to undergo a rather curious process known as conjugation. This process is illustrated for Zygnema in Figs. 6-7. Two filaments first arrange themselves parallel, and contiguous cells send out processes as shown in cell No. 1, Fig. 6. The two processes then fuse and the protoplasm of one cell passes over into that of the other as seen in cell No. 2. In cell No. 3, the two chloroplastids and two nuclei can be made out. The two nuclei finally fuse with each other, but the chloroplastids remain separate. The bodies resulting from the fusion of two cell contents are called zygospores and a row of them is shown in Fig. 7. The zygospores are provided with thick cell-walls, and are capable of enduring extremes of heat and cold. When favorable conditions return, the zygospores germinate and give rise to new plants. The above-described peculiar habit has led plants like Spirogyra and Zygnema to be included in the class Conjugatæ.

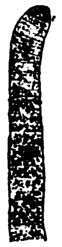


Fig. 1

Fig. 18.

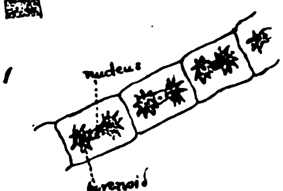


Fig. 5.

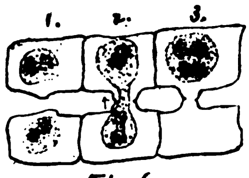


Fig. 6

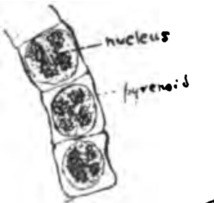


Fig. 7.

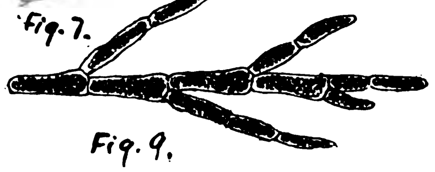


Fig. 9.

The shore of Lake Ontario, where the writer spent the past summer, is composed of beds of limestone of considerable thickness; clinging to this rock in many places are masses of the two algæ, Ulothrix and Cladophora. Cladophora is of a pale green color, while Ulothrix is very dark green, and thus it is quite easy to distinguish these two genera even with the naked eye. The filaments of Ulothrix (Fig. 8) are unbranched and composed of short cells with band-like chloroplastids. The filaments are attached to the substratum by well-marked rhizoid cells.

The filaments of Cladophora (Fig. 9), on the other hand, are much branched and consist of elongated cells. The contents of certain cells in both genera divide up into a number of masses of protoplasm provided with several lashes or cilia, by the movements of which they swim rapidly through the water. These masses of protoplasm are called swarm-spores and one of them, belonging to Ulothrix, is illustrated in Fig. 14. After swimming around for some time, they germinate and give rise to a new filament of the plant.

Vaucheria, which is illustrated in Figs. 10–13, is another rather common genus. I collected a considerable quantity last autumn, and by keeping in a small glass vessel, was able to watch the interesting sexual stages through which it passes. The plant consists of elongated, branched filaments and, although these reach a considerable length, they consist of but a single cell. The extremities of certain filaments become very rich in protoplasm, and this rich portion is finally shut off by means of a cross-wall, as shown in Fig. 12. The end then ruptures and a single swarm-spore (Fig. 11), provided with numerous cilia, escapes. The latter, on germination, will produce a new plant.

In the sexual stage there are two outgrowths produced on the side of the filament; one of these, called the oögonium, is large, rounded, and filled with numerous oil-globules; the other, called the antheridium, is smaller and is coiled somewhat after the fashion of certain snail shells. The initial stage in the coiling is shown in Fig. 10. The final result of all these processes is that the terminal portion of the antheridium divides up into little bodies called antherozoids, one of which is annexed in the figure. An antherozoid now makes its way into the ripe oögonium and fuses with it. This process, which takes place in Vaucheria, is known as fertilization, and the oögonium, after fertilization, is called the oöspore (Fig. 13). The oöspore of Vaucheria is analogous to the zygospore of Spirogyra, and like the latter will develop into a new plant later on.

We thus see that there are two general methods of reproduction among the algæ, one, that by swarm-spores with the object of disseminating the species, the other, that by zygospores or oöspores, with the object of tiding over unfavorable conditions.

Forest Reserves of the United States.

The national forest reserves of the United States now cover an area of nearly 47,000,000 acres, the first reserve, that of 1,200,000 acres in the Yellowstone National Park, being set aside by executive decree in 1891.

THE BIG TREES OF CALIFORNIA.

BY WALDON FAWCETT.

A redoubled effort should be made at this session of Congress to secure action on the part of the national legislature which will save from destruction the famous big trees of the Pacific Coast. This will virtually constitute a last appeal to save one of the greatest natural curiosities on the continent, for almost all the groves of forest giants are privately owned, and more than two score mills and logging companies are to-day at work sweeping these monstrous timber pinnacles from the earth. The plan, as thus far formulated is to have Congress authorize the purchase of the various tracts of woodland monarchs and merge them into one great national park, which would easily surpass in interest every other on the continent with the possible exception of the Yellowstone.

"WAWONA," 28 FEET DIAMETER, 275 FEET HIGH.

At present the ownership of the Big Tree timber lands of California is divided among the State, the Federal Government and private individuals. California owns but one tract, the Mariposa Grove, which covers an area of about two square miles and was turned over to the Golden Gate State by the United States soon after the close of the civil war, on the promise that she would hold and protect it as a State park.

The national government owns and in part controls the two considerable areas comprised in the Sequoia and General Grant National Parks. These parks were established by Congress just about a decade ago, and one embraces over 160,000 acres while the other comprises some 2 500 acres. However, these tracts include only a few scattered groups of Big Trees, and in the case of both parks, sawmills are in operation at the edge of the Big Tree timber, so that the government's treasures are but poorly protected. The private holdings which include by far the greater part of the Big Trees are held almost exclusively by sawmill or logging companies, and so energetic has the lumberman been of late years in the search for food for his mills, that the famous Calaveras or "Mammoth" Grove, which has been so carefully preserved since the early fifties, has lately been acquired by a lumber syndicate.

Investigations recently made by the Division of Forestry of the United States Department of Agriculture prove conclusively that the lumbering of the Big Tree is one of the most destructive forms of industry in practice in this age. In the first place the enormous size and weight of the trees necessarily entails very considerable breakage when one of them falls. Such a tree strikes the ground with a force of thousands of tons, and as a rule the brittle trunk is smashed at its upper extremity into almost useless fragments.

The great diameter of the logs and, in spite of the lightness of the wood, their enormous weight make it impossible to handle many of them without breaking them up, and for this purpose heavy charges of gunpowder are used with results that are sometimes appalling even to the lumbermen themselves. Only the greatest skill in the placing of the blast will prevent an immense amount of the wood being torn into useless splinters; and this loss with the further waste at the mills is such that the governmental experts have come to the conclusion that not less than half of the total volume of the standing tree is lost.

Then there is another and a worse side to the matter. The Big Tree stands, as a rule, in a mixed forest composed of many species, and while the destruction caused by the fall of the enormous trees is in itself great, the principal source of damage is found in the immense amount of debris left on the ground,—the certain source of future fires. This mass of broken branches, trunks and bark, is often six feet or more in thickness and gives rise to forest fires of appalling destructive power, even though the Big Tree wood is not specially inflammable. The strangest feature connected with the reckless devastation of the tracts of Big Trees is found in the fact that in a majority of instances it has been carried on without leaving the owners of the Big Trees as well off as they were before it began.

Many of the characteristics of the Big Trees which make the government officials especially anxious for steps looking to their preservation are not known even to tourists. For instance, the age of the Big Tree establishes its claim beyond question as the oldest living thing on the globe, and whereas the Big Trees were once widely distributed over the earth, they now exists only in ten isolated groves on the west slope of the Sierra Nevada Mountains, and nowhere else in the world. To-day the only hope of perpetuating these wonderful natural curiosities, already so nearly exterminated, lies in the fact that the groves in the southern part of California show some reproduction. In the marvelous groves farther south the species hardly holds its own even where unmolested by the devastating saw of the lumber harvester.

The half a thousand Big Trees, remarkable for their size,—and that is really all that remain,—now huddled in one little section of Uncle Sam's most westerly state not three hundred miles in length, constitute a paltry handful beside the forests of these tremendous trees which, prior to the glacial period, flourished in the temperate zones of the three continents. When the vast avalanche of ice moved down from the north, however, it swept away almost all the monarchs of the vegetation world, and the few survivors that remain to-day occupy, as compared with their former territory, a mere island of space.

The Big Trees of California were discovered in 1841, and the man who first chanced upon one of the monster trees was laughed at when he told of his "find," and had to argue for days ere he could induce any of his companion hunters to accompany him on a second visit to the marvel. In the Calaveras Grove, the one first discovered, and which contains the biggest and tallest trees, there are standing to-day about three dozen trees, none of which are less than 230 feet in height and some of which tower fully 325 feet in the air. The diameter of these giants several feet above the ground ranges from eight to twenty feet.

Many of the Big Trees have been designated by an individual name, and statesmen, scientists, authors, cities and states, have been thus commemorated. There are many novelties, including "Two Sentinels," each over three hundred feet in height; "Three Graces," standing in a close line; "Pioneer's Cabin," named from the cabin-like chamber and chimney formed by the hollow trunk; "Pluto's Chimney," hollowed out on one side by fire for ninety feet above the ground; the "General Sutter," which divides thirty feet above the ground and forms two trunks each 280 feet high, the appropriately named "Siamese Twins" and the famous "Empire State," which is ninety-four feet in circumference.

The felling of some of the Big Trees has presented most dramatic scenes. When one of the greatest of the giants,—the first Big Tree discovered in California, had to come down, a force of five men worked for more than three weeks boring it through with pump augers, and when the stem was finally severed from the stump the tremendous breadth of base enabled the tree to still stand upright so that several days more had to be spent in driving wedges into the butt of the monster to topple it over by force. Then of a sudden a fierce gale sprang up and hurled the Hercules of the forest to the ground with a crash that caused the earth to tremble as from a severe earthquake. Even tearing from one of these giants the coat which has protected it from the elements for centuries, is no mean task, for the bark is often fully two feet thick and almost noncombustible.

The stump of the Big Tree just mentioned, now forms the floor of a good-sized building. On the Fourth of July following its collapse, the young people in the neighborhood held a picnic and a cotillion party of thirty-two persons danced on the stump, in addition to which there were musicians and onlookers sufficient to bring the total number occupying the great slab of wood up to full half a hundred. The dead trees in this congress of giants could tell many tales. There is the "Noah's Ark," a prostrate shell, through which, before its roof fell in, three horsemen could ride abreast. In the "Tree of Refuge," sixteen cattle took refuge one winter, only to die of starvation, and so each monarch has its fragment of individual history.

Some of the Big Trees have been the scenes of stirring adventures, but none perhaps more thrilling than that which befell Andrew Jackson Smith, an old trapper and mountaineer, who made his home for three years in the charred hollow of a burnt-out tree; the great circular natural cabin, more than a score of feet across, serving him as bedroom, sitting room, kitchen, and during stormy weather as a stable for his horse. On one occasion, Smith was in the tree-trunk when a terrific "southeaster" tore through the forest sending down trees on every side. For an interval, every minute of which seemed hours, he waited expecting momentarily to have his towering castle fall about him, but the old tree successfuly weathered the gale, although some of its seemingly hardier neighbors went down before the fury of the wind.

No Big Tree has ever been known to die a natural death. They are exempt from the diseases that cut short the careers of other inhabitants of the forest, and if spared from accident and the vandals who strip off the bark to a considerable height, as has been done in some cases by curio collectors, appear to be immortal. There is no doubt that several of the Big Trees in California are over five thousand years old, and geologists have counted a sufficient number of wood-rings in some of the trunks to prove conclusively that the trees were in their prime, swaying in the winds borne down the slopes of the Sierras, at the time that Christ was teaching in Palestine.

Archaeology

MEXICAN ANTIQUITIES IN ART.

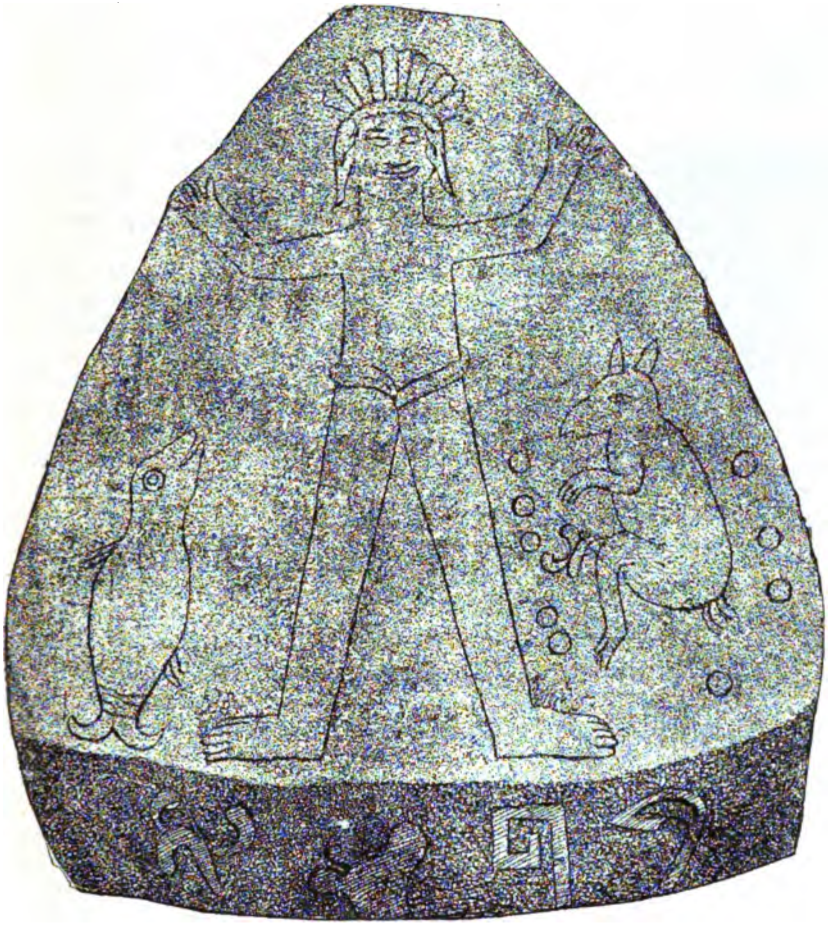
BY JOANNA R. NICHOLLS KYLE.

Very little accurate information can be obtained regarding the petroglyphs or drawings on rocks of Mexico, but it is supposed that a large number remain in the region of the Sierra Madre, for along the seashore of Lower California may be seen representations of fish, of bows and arrows and unknown characters painted upon the high cliffs overlooking the water. Yellow, red, green and black are the colors employed, and most of the figures are at such an altitude as to give the impression that they were executed by a race of giants. In the mission of Santiago, on a smooth rock of great height may be seen stamped in red a row of human hands; but the California Indians when questioned concerning the meaning and history of any of these inscriptions, profess utter ignorance of their significance. It is evident, however, that they were intended as symbols and landmarks for posterity.

In Mexico, on the road from Tlalmanalco to Mecamecan, is a solitary granite rock, artificially cut in the form of a cone, with steps leading up to a platform on its summit, which was no doubt used by the ancients as an astronomical observatory, for on one side of this rude monument appear various hieroglyphs and (more singular still) the profile figure of a man with arms extended and raised, applying to his eyes a tube, or rude optical instrument. Below his feet is a carved frieze composed of celestial symbols, while in front of him a rabbit is seated staring at two rows of numerical figures. A rabbit was one of the four astronomical signs by which the Aztecs adjusted their chronological cycles of fifty-two years, and its presence on the rock evidently indicates some date, probably that of its erection.

Another ancient monument, near Orizaba, Mexico, known as "the Stone of the

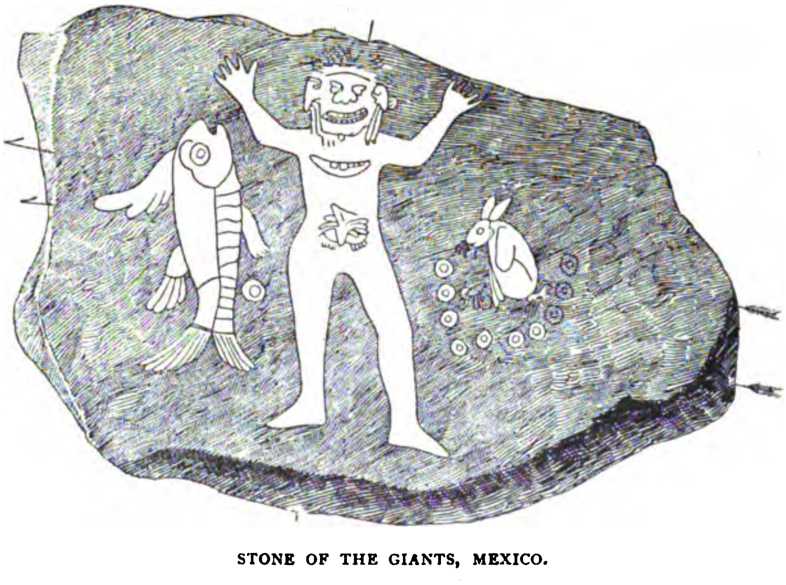
Giants," has created much comment and speculation. This rock is of a dark color, roughly triangular in shape, measuring about thirty feet on each side. The height of the principal figure inscribed upon one side is twenty-seven feet, yet all the lines forming it are deeply and clearly incised. To the right of this giant is a circle and a fish, and on the left is a rabbit surrounded by ten circular depressions (the well known Aztec numerals). By comparison with the signs of the Mexican calendar it will be perceived that the stone bears the date of a certain year and day. The year is that numbered 'ten" under the sign of the rabbit, the day of the year is numbered "one" under the sign of the fish, these precise dates recurring but once every fifty-two years. Archæologists have deciphered the term "ten rabbits" as corresponding with the year 1502 of the Gregorian calendar; and they further state that the time "one fish" probably occurred in the first month of the year 1502, which coincides with our February.



ANCIENT MONUMENT IN MEXICO.

The giant, being a hideous ogre with the grinning teeth of a death's head and long locks of hair falling down on his neck, and having his breast decorated with a human jaw bone, while he appears to be stalking along the earth with arms uplifted and hands open ready to grasp a victim, is no doubt intended for the Aztec god of death, Tzontemoc Mictlanteculi, "the Lord of the Realm of the Dead, He of the Falling Hair," whose distinctive marks are the enormous size, the death's head, falling hair, and the jaw bone.

All the wonders of ancient Mexico have not yet been revealed. In the early days of the nineteenth century, a large cylindrical stone, both sculptured and painted, was discovered while making excavations at the Place d'Armes, in the City of Mexico. This object was a relic of religious veneration known by the name Teocuanhxicalli, the sacred drinking vase of the eagles, (more literally translated) "the vase of god and the eagles," the name being derived from Teotl, god; cuanhtli, eagle; and xicalli, a hemispherical vase. The precious relic was covered with designs which are found reproduced in paintings on deer skin and copied in manuscripts and rituals, the figures being meant to represent gods, conspicuous among them being the god of war, to whom the stone is also dedicated. Those figures on the upper part of the stone had their faces raised to the sky, in which appeared an object resembling a familiar astronomical sign. The monument was also adorned with symbols, birds, quadrupeds, fantastic reptiles, signs of the sun, days, months, etc. M. Raphael Gondra, director of the national museum, took the dimensions of this unearthed treasure, made a hurried sketch of it and ordered that it be reinterred as "the necessary funds were lacking to exhume it entirely and transport it to the museum." Thus Spain's depleted treasury lost to archæology this curiosity of the past, for its hiding place cannot now be discovered, though attempts have since been made to find its whereabouts in the vicinity of the Place d'Armes.



STONE OF THE GIANTS, MEXICO.

In concluding this brief sketch, a few striking figures of gods, taken from the Maya mythology, which deities also appear in the Mexican codices, are given. The god Ekchuah, whose name signifies the Black Calabash, a hideous conception, whose head strongly resembles a calabash, or gourd, cut in half to make a dipper, (this being the symbol of the deity), was considered by the Mayas as the patron and protector of all peddlers and traveling merchants.

Another odd object of worship was the "long-nosed god," or "god with the snake-like tongue." He was supposed to be the giver of rain, and his personation appears very frequently in all the Mexican manuscripts. In the Dresden Codex it appears twenty-eight times, figured in connection with water. Twice he is colored black, possibly to indicate the darkness of a raincloud, and twice blue, to symbolize water. The snake-like tongue and the peculiar eye are his invariable characterizations wherever he appears, either as sitting on the water, riding in a boat, or accompanied by a fish, sometimes by a bird) the symbol of the atmosphere), or as holding torches in his hands. It is noteworthy that the most important deity of Maya worship was Kukulcan, who coming from the far East created the civilization of the country, his name signifying bird-snake, or feathered-snake, perhaps identical with the Mexican rain god.

Zamna, denominated by students of antiquities, "the god with the old man's face," who was a defied Maya hero, appears a few times in the Dresden Codex. His presence is connected with bees and the making of honey, also with the cultivation of cacao. He it is who takes an active interest in the manufacture of idols and in painting.

The god with the banded face, possibly Cumahau, of Hunhau, the Prince of the Lower Regions in Maya credence, seems to be closely allied with the god of death. In Plate 10 of the Borgian Codex, this relation between death and the nether world is distinctly marked, the head of death being crossed with a black band.

The Saginaw Valley Collection.

The American Museum of Natural History, in New York City, issues a supplement to the American Museum Journal, each copy of which relates to some specific case or collection in the museum. In the number with the above title, Assistant Curator Harlan I. Smith, speaks of a collection of archæological objects found in that section of Michigan. We extract the following:

The rude archæological objects found in the Saginaw valley, Michigan, and exhibited in the American Museum of Natural History show that the prehistoric people who lived in that area were largely occupied with striving for the necessaries of life. The region, although not at all desolate, was still too far north to support a civilization that would leave traces of a culture so largely given to art and ritual as those to be found in Mexico, the southern states or even in the Ohio valley. Such a collection of rather rude implements and objects has value, however, in that it gives evidence regarding the lives of the early inhabitants of the country.

The objects from the Saginaw valley were found in such places that we now know where there were a number of rather important villages and a still larger number of small villages or camp sites, besides what were probably scattered habitations and burial-places—all of the early people of this region. It is quite evident from areas where certain stray objects were found, and from the scarcity of other evidences in such areas, that the people also made trips to points remote from the villages, probably for fishing and hunting, the gathering of fruits and roots or the securing of material out of which to make arrow-points and pipes; and that the objects were lost on the way. It would seem that the character of the country, with the scattered distribution of its products, was the cause of the segregation of the people into small villages, and possibly of their establishing small outlying camps for the purpose of being, at certain seasons, near points suitable for such occupations as are above noted.

The importance of the collection exhibited in these cases is chiefly that it indicates the character of the culture of the people, the location of their habitations, burial-places, caches and mounds, as well as that it shows something of their resources, industries and customs. It is undoubtedly the largest archæological collection from the Saginaw valley, and was made and presented to the museum by the writer, whose investigations of the region, although supplemented by later work, were chiefly accomplished during the period from 1883 to 1891. Practically all the objects to be found on the surface of the particular sites from which the collection was obtained have been secured; but it is probable that further search, especially below the surface and in the neighboring fields, would bring to light other specimens of similar nature.

The Saginaw valley, including the entire area draining into Saginaw Bay, occupies the east-central portion of the southern peninsula of Michigan. It is a well-watered, level country, formerly covered by dense forests of pine, oak, elm, ash, maple, hickory and other trees. The lowlands are occupied by swamps, which in places are largely grown up with wild rice, known to botanists as Zizania aquatica Linn, a staple produced by nature in such abundance that it was of great importance to the primitive people of the region. The streams which were of the most importance to the prehistoric inhabitants of the valley were the Saginaw river and its main tributaries, including the Shiawassee, Flint, Bad, Cass, Tittabawassee and their branches, while the Pigeon, Sebewaing, Kawkawlin and Rifle were not unimportant. Bordering the lower courses of the rivers there are numerous bayous with low sand ridges scattered over the land between them. At the head waters the streams flow more swiftly and undercut their banks, and large bayous and swamps are less frequent.

Chert or impure flint was extensively quarried and chipped into implements by the prehistoric inhabitants of the valley, and in the chipped implements found on the village sites and hunting grounds this material largely predominates. This outcrops in a nearly circular line cut by the head waters of the Cass, Shiawassee and Tittabawassee, and intersecting Saginaw Bay near Point Lookout and Bay Port.

When white men first visited this region, it was inhabited by the Ojibwa Indians. The prehistoric villages were located along the streams, because of the importance of water, wild rice, fish and the land animals which frequented the river banks for food or visited them for water. Furthermore, the canoe was an easier means of transportation than the trail, and even trails were more easily formed along the ridges parallel to the rivers or along the banks than elsewhere. The outcrops of chert and pipestone also are exposed by the rivers, while in other places they are covered with soil. From such exposures canoes could easily descend to villages along the rivers, while to carry the material by trail to inland settlements would have been laborious.

The evidences from the numerous village sites and the burial-places, mounds and other remains, indicate that the conditions of life in prehistoric times were similar to those which existed when the Indians were first met by white men. Fragments of pottery; pebbles which have been burned and broken, probably while used as supports for the round-bottomed pottery cooking-vessels; ashes and charcoal; the broken bones and shells of animals; arrow, knife, spear, scraper and drill points of chert; points made of bone, for arrows or awls; celts or chisels; hammer-stones; grooved axes; ornamental objects, etc.,—all are to be seen in this case. A number of such objects when found on the surface of the ground at a particular place, especially if pottery is present, constitute the evidence which proves the spot to have been a village site. Charcoal and ashes alone are not conclusive proof of a village site, since such remains may have been left by white people of recent times.

Totemism in Australia.

The religious side of totemism is indicated in the 'Intichinma' ceremonies of the Arunta tribe, which are directed apparently solely toward the end of increasing the supply of the totem animals and plants of the district, each totem group being charged with the treatment of its own totem object and its multiplication for the benefit of the other members of the tribe.

The well-known prohibition against killing and eating the totem seems to hold in this region, but tradition and ceremony point to a time when this was not the case. This economic explanation of the custom is the first satisfactory one yet offered and is plausible, though it may not hold for other parts of the world. The social aspect of totemism with its marriage regulations still remains a problem.

Colosseum of Rome.

The Colosseum of Rome was built to accommodate 100,000 spectators. It was 120 feet high and covered 1½ acres of land.

Minerals

[Edited by A. C. Bates].

Stalactites are composed of calcium carbonate and some accidental impurities, are classed as a variety of calcite or aragonite, and occur in most of the caves of the earth.

The wondrous beauty of some caverns is due to the abundance of their calcite formations; and these objects, curiously resembling nearly everything that nature or art produces, cannot be formed unless water drips so very slowly from the roof of the cavern that it leaves some of the limestone it has held in solution behind it as the drops fall to the floor. The bit of mineral left on the roof receives a tiny accretion of lime from the next drop, and so the pendant mass, assuming the most curious forms slowly grows downward and outward, sometimes round and slender and again broad and massive.

A cavern discovered in the Copper Queen Mine, at Bisbee, Arizona, contained what was considered from a collector's point of view the finest stalactites ever found. Delicately fantastic in make up, some of the stalactites were so thin and broad as to suggest a waving flag, some showed pearly tintings and others varying shades of green, caused by the copper-laden drippings. The removal of these stalactites was made necessary for the further development of the mine, and the best of them are now in museums and private collections all over the world. The New York Museum of Natural History has one of its largest cases filled with these stalactites.

Early in January there was discovered at a lime quarry near Somerville, N. J., a series of narrow cavities, one about 100 feet long, which contained many graceful stalactites depending from a snow white roof. The owner of the property had no realization of the value of the discovery because he permitted any one to enter, and with the usual results,—vandalism. It is said that not one of the stalactites of the long apartment were left in place. Properly guarded as soon as found, and then nicely developed, these caverns, so near to a great many people, should have yielded both pleasure and profit.

The small caverns are generally the most beautiful. Diamond Cave, of Kentucky, and Organ Cave, of Virginia, are very much more beautiful than are the Mammoth or Wyandotte with their miles of passageways. In the Organ Cave the sweetest tones may be elicited by striking with a stick the slender columns of drip stone. The Adelsberg, in Austria, is the finest of the European caves. But on the whole our caves are much more extensive than those of Europe, and some are just as varied and picturesque as the show caves of that country.

STALACTITES, BISBEE, ARIZONA.

Epidote.—The finest crystals of this mineral occur in an epidotic schist at Untersulzbacthal, Pinzgau, associated with asbestos, adularia, apatite, titanite, etc. The crystals are a pistachio-green, often transparent, complex of form and are usually found in splendid groups or bunches, and always have been much prized by collectors. Until recently there was no important American locality. Late in 1901 there was a remarkable find of epidote in the Green Monster Mine at Ketchikan, Alaska. These epidotes rival the Tyrolese specimens but are entirely different, being much stouter, often doubly terminated and twinned. Some of the smaller groups are nicely associated with quartz crystals, which have a greenish tint, and these make very attractive specimens. The finest of these epidotes thus far mined was sold for $50.

A Diamond is as much alive as a man. Thus declares Prof. Von Schroen, of the Naples University. According to him, the so called inorganic bodies possess quite as much life as organic ones. He also claims to have photographs of the chief events in the life of a crystal, from its birth onward. One of the most curious of these is thus described: "The crystal meets another one from a different mother. The two strike at each other; they fight, strive and clasp with each other. It is war to the death. It is a case of the survival of the fittest. One must die. But no two crystals from the same mother ever fight, no matter when they meet." In this particular crystals seem to be superior to human beings.

Proustite, commonly called ruby silver because of its color, is an ore which contains 65% of silver. It occurs massive, compact and crystallized. Some crystals found at Chanarcillo, Chili, were three inches long and transparent. The rich ruby color fades on long exposure to the light, and the once transparent crystals become opaque in consequence. There is a splendid suite of crystals of proustite in one of the cases of the American Museum of Natural History, over which is spread a blanket of black velvet to exclude the light, but which may be lifted by visitors to view the crystals.

Minerals in Poetry. There is poetry in crystals, but there is little about crystals in poetry. As a subject, minerals have engaged the poet's muse but rarely. Some of the gem minerals have been used by poets as a symbol of color, as "A sea of sapphire set in emerald," "ruby lips," "topaz hair," "eyes like diamonds," "amethystine hues," etc.

If poetry is the language of the imagination then surely some of Nature's dainty work, with her subtle chemistry in the building of ideal forms and coloring them with exquisite tints in the caverns of earth, should appeal to poets as worthy of description in verse.

Green Gem Stones in jewelry are now ultra-fashionable, and prices for semi-precious stones of good green color have considerably advanced. Of these stones the most sought for is chrysoprase, a green variety of quartz, of which a vein of finest quality was discovered in Tulare County, Calif., a few years ago, but which was soon exhausted by mineral collectors. Tourmalines of deep green color fetch upward of $30 per carat, according to brilliancy, but they are not hard enough to stand constant wear. The emerald, of course, leads all the green colored gems because of its distinctiveness and rarity in good specimens.

Asbestos is in growing demand for commercial purposes. The mines of the Thetfort district, Quebec, furnish most of the asbestos that comes to this market. The rock in which the asbestos occurs is of a gray or green serpentine, the veins of asbestos varying from a mere thread to a thickness of six inches. Veins of two and a half inches and upward are regarded as "extra No. 1," and from this is spun the thread from which fire-proof curtains, fireplace mats and kitchen accessories are made. The shorter fibres are ground up for use as a plastic for pipe and boiler coverings and steam packing. The best quality of asbestos is worth about $300 a ton.

No Diamonds Found in Montana.

State Senator Hobson, who is largely interested in the sapphire diggings in Fergus County, declares the story in circulation throughout the East of the many diamonds being found in this State is a myth. The stone that is creating all the furor is a hard white sapphire.

Photography

CONVENIENT DEVELOPING.

The method of "stand" development which has latterly been so much advocated and would seem to have become so popular in Germany, presents nothing really new in principle, but has been more or less perfected in detail, and, moreover, has been brought so much more within the sphere of daily photographic work by the introduction of the newer non-staining developers, that it deserves the careful attention of every photographer who wishes to be acquainted with all methods that are likely to be helpful to him.

The plates, instead of being developed singly in dishes in a horizontal position, are placed, several at a time, in a vertical position, in suitable grooves in a trough or tank made of papier maché, celluloid, porcelain or glass, and provided, if possible, with a deep lid which will exclude both dust, and, to a certain extent, air. Papier maché, wood pulp and celluloid are less likely to break the plates than porcelain or glass. Glass has the advantage over the other materials that it allows the plates and the liquid to be seen, but the disadvantage that it affords practically no protection from light. On the whole my own preference is for tanks of celluloid, papier maché, or some similar material. The plates may drop into fixed grooves, or what is rather more convenient, may be contained each in a separate holder so that any plate can readily be lifted out and examined. Various forms of tank for the purpose are now on the European market; the best of them are so arranged that the lower edges of the plates do not actually rest on the bottom, but are supported from 10 millimeters to 20 millimeters above it.

The tank is filled with a relatively dilute developing solution, and the time required for development may be made to vary, at will, from fifteen or twenty minutes to ten, twelve or fifteen hours by simply altering the degree of dilution of the developer. It will be seen at once that for this process we require developers that are not very readily acted on by air and are not liable to produce stains. Most of the newer developers can be used, but pyrogallol is not very suitable. In Germany a favorite developer for the purpose is glycin made up according to the usual formula: 25 grams of crystallized sodium sulphite are dissolved in 40 cubic centimeters of hot water, 10 grams of glycin added, the mixture heated to boiling and 50 grams of potassium carbonate added gradually. The mixture is kept in well-closed bottles and is well shaken before being measured off. For stand development it may be diluted with 50 times its volume of water, and development will then require about an hour if the plates have received a normal exposure; if they have been over-exposed fifteen minutes may be sufficient. By increasing the degree of dilution, the time of development may be increased to almost any desired extent.

The writer used with satisfactory results ortol, adurol, metol, hydroquinone, and the still newer developers, imogen and imogen-sulphite. The mixed developer, made up in accordance with any of the formulas given in a previous article, may be diluted with from five to ten times its volume of water or even more. It is important to observe that the proportion of sulphite in the solution should be kept as low as is compatible with the prevention of discoloration, because of the slight solvent action exerted by this salt on silver bromide.

The first advantage of the method is that development proceeds so slowly and regularly that a few minutes more or less makes no practical difference in the result, and consequently plates which have received different exposures can be developed together and each can be removed at the most suitable time. Secondly, plates which for one reason or another, exclusive of exposure to light, show a tendency to fog when treated with developers of ordinary strength, will often yield brilliant negatives with a much weaker developer. Further, there is for the professional worker a considerable saving of time and trouble. A dozen plates can be developed at once, and if the exposures have been fairly correct, frequent examination of the negatives is unnecessary, and it is therefore possible to get on with other things while development is proceeding. If the developer is made sufficiently dilute, a business man may set development going before he leaves home in the morning and find his negatives ready for fixing when he gets back in the evening. If desired, the process may be allowed to go on through the night. In such cases a very dilute developer is required, and it is advisable to have rather more space between the plates than is necessary with a stronger developer.

When the exposures are uncertain, and may vary widely, each of the plates should be examined after they have been in the developer, say, ten minutes, and any that show signs of excessive over-exposure or under-exposure can be removed and treated specially. It may be well to point out that the indications of under or over-exposure will not be quite the same as when using developers of full strength and a little experience is necessary in order to read the indications correctly.—Anthony's Photo. Bull.

Fading of Photographs.

The one great lesson to be learned from a close scrutiny of a family album is doubtless the liability of photographs to fade, especially those printed on certain classes of paper. This fading is also more noticeable in the case where sitters have been very fully lighted, and there is an absence of shadow or dark portions in the picture. A solid printed picture will first show signs of decay in the half-tones, the darkest portions not being so noticeable, and a black dress will appear to wear better in a picture than a lighter or middle-tint one.

If any one closely studies the numerous examples to be seen in any large family album it is more than likely that he will be forced to the conclusion that a lightly printed picture does not last as well as one printed darker and toned to a good purple black, while photographs enamelled by means of collodion seem to be proof against the fading so noticeable in other examples, where enamelling has been produced by means of burnishing; in the latter case the chief characteristic of such a treatment being their liability to turn yellow, while carbon prints, both in enamelled and simple form, are as permanent as any one can desire, any deterioration being generally attributable to an abrasion of their surface.—Brit. Jour. of Photog.

A New Substance.

We learn through the American Chemical Journal that Professor Holmes has discovered a substance which will bear the ponderous name of paranitrobenzoylureaorthosulphonic acid. We fear the old silver stained veterans would hardly survive the shock if this acid should ever enter the darkroom. It is quite possible, however, that it may be utilized in photography, as Professor Holmes reports that it forms salts with silver, potassium, sodium, etc. The silver salt would maintain its identity under the following formidable combination of letters—paranitrobenzoylureaorthosulphonate of silver.

Big Electrical Plant for St. Louis.

The electrical plant at the St. Louis World's Fair will be twice as large as any ever seen at an exposition in this country, and larger than any ever provided at an exposition anywhere. A plant of at least 30,000 hp. is contemplated, and work upon it has begun. The most attractive use of the lights will probably be in connection with the cascades. It is expected to introduce an entirely novel effect, and one which at the same time will be in conformity to the other features of the exposition. Back of the cascades powerful electric lights will be introduced, which will illuminate the broad sheets of water and make them visible at night from fully half the points on the grounds. The idea of throwing powerful lights on cascades and fountains from the outside has been carried into effect before with pleasing results, but the visibility of the mechanism destroyed the illusion.

Hall of Fame.

The selection of the additional 21 names for the vacant panels in the Hall of Fame, in New York, has been postponed till 1905.

Various Topics

ADVANCEMENT IN APPLIED SCIENCE

BY R. I. GEARE.

One of the wonders of the 19th century inventions was the Hoe octuple printing-press. Without tearing the paper or getting out of adjustment, it automatically prints, cuts, folds and counts 1,600 papers a minute, weighs about 60 tons, and is composed of 65 000 different parts. It is the result of inventive genius of Messrs. Hoe and Tucker, who secured their first patents in 1859. The first machine was set up in the office of the New York Tribune.

A machine called the "linotype," was devised a few years ago by Ottmar Mergenthaler, a Baltimorean, for setting type. The saving of time is enormous, and its practical utility is best proved by the fact that although the cost is $3,000 each, over 5,000 of them are already in use in the United States alone.

The art of photography has advanced with rapid strides of late years. At an early date alchemists discovered that fused chloride of silver would blacken upon exposure to light; later it was noticed that the salts of silver turned color when similarly exposed. These discoveries may be regarded as the working principle in photography. In 1839, Daguerre perfected the process called after his name. It consisted of a polished silver-surfaced plate upon which vapors of iodine had formed, thus producing a layer of iodide of silver. After exposure in a crude camera, the object was made visible to the eye by subjecting the sheet to the vapors of mercury and this was the beginning of practical photography. In 1851, the collodion process was inaugurated. The iodide and bromide of silver are used very extensively for preparing the film for exposure in the camera. Of late years the film camera has met with great approval for taking snap-shots, wherein a minimum of space compensates for accuracy in detail. There are numberless grades and makes now on the market.

One of the latest discoveries in the world of physics was the liquefaction of air. Chlorine gas was brought to a liquefied state as early as 1805, by Northmore, and again in 1823, by Faraday. A little while afterward sulphurous acids were converted into liquid form. In 1834, carbonic gas was liquefied by Thilorier. Meanwhile Perkins (1823) had been experimenting with the liquefaction of air, but, although there were many attempts, practical results were not attained until 1877. Oxygen and hydrogen gases had been liquefied independently by several physicists of note, and since these are the principal constituents of the ordinary air, the liquefaction of the combination might be expected to soon follow.

Liquid air, which has created so much wonder by its startling action upon different substances, is simply air which has been compressed and cooled to what is called its "critical temperature," i. e., the temperature at which it passes into another state of matter,—in this case from gas to liquid. The same is accomplished when the air is compressed to $\frac{1}{800}$ of its volume; i. e , a pressure of about 2,000 lbs. to the square inch at a temperature of—312° to —315°. This is done by machines devised for the purpose, in which the air while compressed is at the same time cooled. The drop in the temperature is effected by a process known as self-intensification, through which the liquefying air is made to supply its own cold. The process is simple, although long. The general opinion with regard to the newly discovered liquid now seems to be that its use will be confined to refrigerating and explosive purposes. There is apparently no way to confine it, for upon heating it in a closed space, the pressure will reach 12,000 lbs. to the square inch. For this reason it is at present inadmissible as a source of power for locomotion.

Until electricity can be directly produced from the combustion of coal, the steam engine will probably continue to be used. The invention of the steam engine goes all the way back to the second century before Christ, when Hero is said to have made the first one in Alexandria. Nearly eighteen centuries passed before active interest in this form of machine was revived, and the work of James Watt, preceded by the experiments of Branca, Papin, Newcomen and others, has now resulted in the almost human locomotive of the present day. The stationary engine may be mentioned here, and the rotary style known as the "turbine" is perhaps the most successful as regards high speed. In this form of engine jets of steam are directed against the buckets in the same way as water on a water wheel.

The first locomotive to run on rails was Trevithick's (1804) and was built in Wales, while the first one to run on rails in this country was the "Stourbridge Lion," imported from England in 1829; a model of this engine is in the National Museum. The first railroad in the United States was built near Quincy, Mass., in 1826, a small affair, but the growth in track-building may be imagined from the statement that there are now in use not far from 300,000 miles of tracks in the United States, counting second tracks and sidings.

Many of the same men who experimented with the steam-engine also applied themselves to the invention of boats which could be propelled by steam, but it was not until the nineteenth century that this form of vessel was put into practical use. The first steamboat was built in 1801 by William Symington, and was used on the Forth and Clyde Canal in 1802. In 1804 Colonel John Stevens made a steamboat on the Hudson river. Three years later Fulton built the "Clermont," and thus established steam navigation between New York and Albany. The first steamboat to run on the Mississippi was the "Orleans," built by Fulton and Livingston in 1811, and is recorded as having steamed from Pittsburg to New Orleans in 14 days. In 1819 the "Savannah" made the first trans-Atlantic trip in 26 days, having only a tonnage of 380. Five years later an English steamer went to India around the Cape of Good Hope. The later improvements both for river and ocean travel are now well-known, the latter class including such magnificent ships as the "Celtic," "Oceanic," "Kaiser Wilhelm," "Deutschland," etc. The maximum speed of the last mentioned is 23.5 knots per hour.

The application of steam engines to war vessels was made in 1814 by Fulton for the defense of New York harbor; the first ship thus fitted up was the "Demologos." The development of this industry is one of the most stupendous in the world's history, as may be inferred from the fact that in 1898 the tonnage of the war ships of the six leading navies of the world aggregated the enormous total of 3,631,932.

During the latter years of the century engineers devoted considerable attention to the development of the steam turbine, one of the oldest forms of steam engines. Its simplicity and compactness of form are among its principal advantages. It requires very little attention and has few valves or rubbing surfaces. The wear of the blades is said to be almost inappreciable where superheated steam is used. At the Paris Exposition, 1900, the de Laval Company exhibited a 300 horse-power turbine wheel in which the blades showed no apparent wear after seven years use. One of the largest steam turbines was made by the firm of C. A. Parsons and is now in use in Elberfeld, Germany.

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Commerce and Vessels.

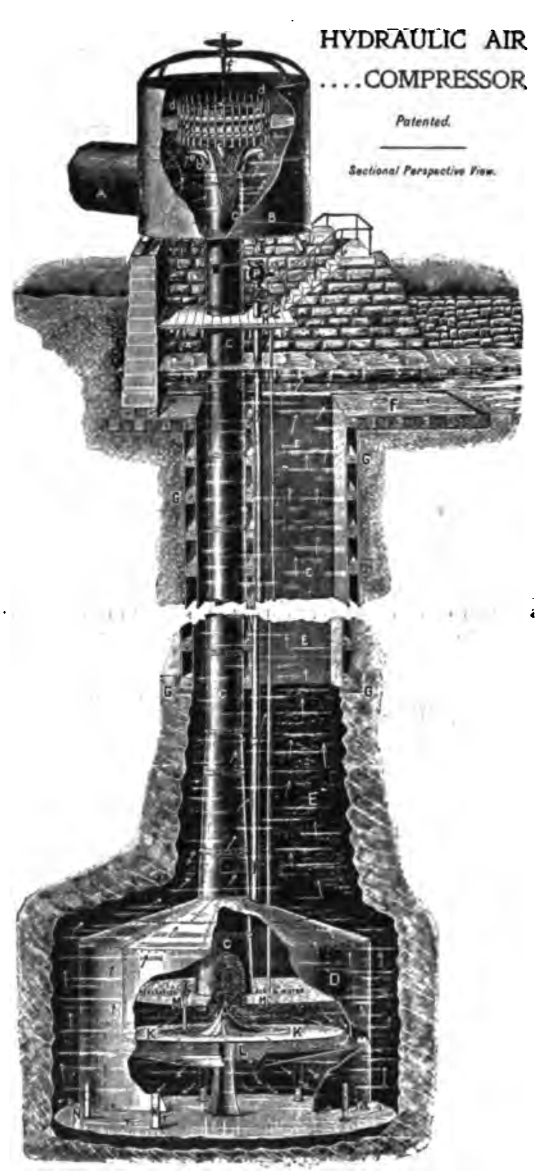
The enormous proportions attained by modern commerce is well illustrated by the tonnage of the new ships built from year to year. For instance, in 1900, there were constructed a total of 1285 vessels of over 100 registered tons. Of this number 319 were sailing vessels, and 966 steamships; 698 of these were built in England or her colonies, and 197 or only 15% of the total number were constructed in the United States.

The total capacity of the American built vessels is about 300,000 tons burden. This seems like a goodly amount; still its insignificance is well illustrated by the fact that it would require eight months for a fleet of this tonnage to transport from Baltimore to Marseilles the coal imported by the latter city in one year, providing that we were fortunate enough to supply the entire amount that they annually consume.

NEW PLANT FOR COMPRESSED AIR.

BY HARVEY M. BRIGGS.

Compressed air has been growing in favor among the modern machine shops in this country until it is difficult to find a shop without an air compressor. Compared with the other method of transmitting and distributing energy, it has no equal in economy, convenience or safety; but compressed air has been obtained only by means of a mechanical air compressor operated by steam or some other power.



The new method of securing compressed air from the direct action of a water-fall has been utilized, and the first hydraulic compressed air plant in the United States will be set in operation at Norwich, Conn., within the next few weeks.

The plant at Norwich has been in the course of construction for the past two and a half years by the Continental Compressed Air Company, of Philadelphia. The idea of the method is as follows: A shaft is sunk into the earth, near a waterfall, to any desired depth; an iron pipe is placed within the shaft; at the bottom of this shaft is a tank or separating chamber to receive the air. The falling water is conducted to the top of the iron pipe and discharged therein, the water falling down through the pipe to the bottom of the shaft and returning to the surface. The shaft is made large enough to allow the water to return to the surface within the shaft on the outside of the down flow pipe. The falling water entrains the air in the form of bubbles and carries these bubbles to the bottom of the shaft; at this point the air separates from the water, the air remaining in the tank below, the water continuing on its course up the shaft and into the stream. A pipe is connected with the separating tank, and through it the air is conducted directly to the cylinder of an engine. As the pressure under which the air is delivered depends solely on the weight of the returning column of water, any pressure desired may be had by sinking the shaft to a greater or lesser depth.

The company in looking over the Eastern part of the United States for a favorable place to locate such a plant, found an ideal spot on the banks of the Quinebaug river in the eastern part of the town of Norwich, and began the construction of a dam and the sinking of a shaft there during the late summer of 1899. The daming of the stream proved a longer and more difficult task than was at first expected, and the partially completed works were washed away several times in freshets before they were made formidable enough to withstand the swift current of the river. The sinking of the shaft occupied more time than it was considered necessary to sink two similar holes.

It has been sunk through solid rock to the depth of over two hundred feet, and so hazardous has been the work that local laborers would not engage in it, and it was necessary to secure miners from Kentucky to drill down into mother earth. A heavy stone and cement dam has been constructed across the river in a narrow gorge, and the shaft has been sunk to the depth of 203 feet. It is 24 feet in diameter and flanges at the bottom to the diameter of 50 feet. At the bottom there is also a storage chamber, extending horizontally one hundred feet from the shaft, and 24 feet high. The steel tube and lining has been placed in the shaft, and with a few more finishing touches it will be ready for use. There has been laid to the city and through the principal streets 16 inch iron pipes which will conduct the air to the manufacturing concerns.

This plant will give 1,365 horse-power in air at a pressure of 85 pounds to the square inch. The head of water is 18½ feet, the diameter of the shaft 24 feet, depth of shaft 203 feet, and diameter of compressor pipe 14 feet. The air will be transmitted at a distance of four miles with a loss in transmission of not over 2 per cent. The only expense attached to such a plant is practically its first cost of construction. It works itself and requires no attendants and no costly fuel.

While this is the first plant of its kind to be built in this country, it is not an experiment, as a similar plant is running in Magog, Canada, furnishing power for the Dominion Cotton Mills Company. Another plant is in operation at Ainsworth, British Columbia. The Norwich plant is, however, much larger than either of the Canadian compressors and is the first one where power will be furnished to an entire city. All the large concerns are making preparations to use the air in place of steam, and the starting of the plant is awaited with much interest.

The Norwich plant has been constructed at a cost of about $500,000, and its success is likely to be followed by the building of others on the same stream. Within a distance of three miles the company can build two more compressors. While the local demand will not require all three compressors, in the event of the construction of the other two, a pipe line will be laid to New London and Groton, a distance of fourteen miles, to supply those places with power. The trial of the new compressor will be made in a short time, and its operation will be watched with no little interest by everyone in that vicinity, and scientists and mechanics throughout the country. Col. John A. Inslee, of Philadelphia, and a corps of assistants has superintended the building of the plant.

The accompanying cut shows a sectional perspective view of the compressor. The working of the compressor is as follows: The water is conveyed to the tank B through the penstock A, where it rises to the same level as the source of the supply. In order to start the compressor the headpiece J must be lowered by means of the handwheel f, so that the water may be admitted between the two castings b and c. The supply of water to the compressor is governed by the depth to which the headpiece is lowered into the water. The water enters the compressing pipe between the two castings b and a, passing among, and in the same direction as the small air inlet pipes. A partial vacuum is created by the water at the ends of these small pipes, and hence atmospheric pressure drives the air into the water in innumerable small bubbles, which are carried by the water down the compressing pipe C. During their downward course with the water the bubbles are compressed, the final pressure being proportional to the column of return water in the shaft E and tailrace F. When they reach the disperser K, their direction of motion is changed, along with that of the water, from the vertical to the horizontal. The disperser directs the mixed water and air towards the circumference of the separating chamber D. Its direction is again changed towards the center by the apron L. From thence the water flows outwardly and, free of air, passes under the lower edge of the separating chamber. During this process of travel in the separating tank, which is slow compared with the motion in the compressing pipe C, the air by its buoyancy has been rising through the water and pipes M, M, from under the apron and disperser, to the top of the air chamber D, where it displaces the water. The air in the chamber is kept under a nearly uniform pressure by the weight of the ascending water in the shaft and tailrace.

The air is conveyed through the main I up the shaft to an automatic regulating valve, and from thence to the engines. When sufficient air has accumulated in the separating chamber to displace the water almost to the lower end of the compressing pipe, it escapes through the blow-off pipe H.

COLORADO HIGHWAYS and BYWAYS.

BY H. A. CRAFTS.

Both the climate and soil of Colorado are favorable to good roads, which are now exciting so much attention. Topographically the roads must be divided into two classes—the mountain road and the plains road. It will, of course, require more time, more people, and more money to make the roads perfect. With an area of more than 103,000 square miles, and a population that has but recently passed the half million mark, it is not to be supposed that the best of roads can be secured Yet considering all things the roads of Colorado are remarkably good, a fact not so much attributable to the expenditure of money and labor, but to a dry climate and a firm soil.

The plains, which constitute about one-third of the state's area, are composed largely of clay, with a sand and gravel mixture in places. Indeed so large a component part of the soil is clay that the brick-makers have but little difficulty in finding favorable locations for their yards. The Colorado manufacturer can find a good clay bed upon almost any knoll upon the prairie lands, and he takes the clay from the surface down to a depth from three to six feet. The clay, called "dobe," is dry and sun-baked, and this constitutes the greater part of the plain's surface.

It will readily be seen how it should make good roads. Unless thoroughly soaked it is almost as hard as a rock, and will wear under the pressure of heavy loads or constant attrition. An ordinary rain will moisten it, say to the depth of an inch or two, which makes it a little sticky, without weakening its substance. A day's sun and wind will dry it out, and the surface of the ground, though somewhat uneven, will be as hard as ever.

Originally the roads of Colorado, at least those upon the plains, followed the shortest line between two given points, making due allowance, of course, for an occasional slough or quicksand, or a butte on a ridge of rocks. The rivers were forded or ferried, and, when one track became worn or washed out, a new one was formed by its side. Now and then there was a sandy flat to pull through, and occasionally a piece of stony country to shake things up and make the drivers cross; but as a whole the roads wound over the undulating plains in easy curves and afford no serious obstacle to easy and continuous progress.

But, with the gradual settlement of the country, due regard had to be paid to section lines, and the old pioneer freighters cursed the day when the homesteader began to get in his work. For they not only lengthened his journey, but crowded him aside into many a slough or sand-bed that required any amount of flagelation to pull through, and not infrequently mired him down. Still even to this day there are long stretches yet unimpeded by fence or irrigating ditch, where the traveller steers his course dead before the wind as a sailor would say.

Nor must it be supposed that the advent of railroads has done away with that ancient highway known as the "Old Overland Trail." In places its original course has been changed to conform with the requirements of landed proprietorship, yet its general trend remains unimpaired, and at nearly all times of the year the prairie schooner may be seen pursuing its laborious journey along its narrow and sinuous pathway. From the eastern boundary of the state it follows the South Platte valley to Denver and then, turning northward, follows very closely its original course as far as the Cache la Poudre river, where it turns again slightly westward, and, entering the foothills, winds onward into Wyoming.

From Missouri to Oregon and Washington a restless tide of humanity flows and ebbs along its dusty track. In nearly every case they go in trains of from three to a dozen wagons, drawn by weary and foot-sore horses or mules, bearing the sun-browned wives and children, and the few household goods of the unkempt drivers, who for miles trudge by the wayside. Will they ever reach that haven of rest that they so eagerly seek?

But the settlement of the land not only changes the direction but the character of the roads. Of course, they do not run on so easy grades as they did under the old conditions, being now confined within arbitrary limits. Irrigation probably works more damage to Colorado roads than any other one thing. Seepage will change a nice, long, level stretch of road to a veritable slough, and then the whole has to be ditched and turnpiked. The farmers in many cases are neglectful in their irrigating and permit their waste water to flood the roads. Storage reservoirs, that are now multiplying upon the plains in eastern Colorado, are another menace to adjoining highways. Sometimes they break their banks and flood the roads, or their banks slowly seep and fill the ruts with water. Against the neglectful handling of water, whereby country roads are damaged, there is a law making the offense a misdemeanor, and prosecutions occur very frequently in the agricultural districts under its provisions.

It cannot be said that the public highways improve greatly with the settling up of communities. The damage from flooding and seepage increases, and there is an increase in the use of heavily-loaded vehicles, which, passing to and fro over the roads in all weathers, cut it up into ruts, which, even when the moisture is dispelled, leaves the roads in a very uneven condition. Then the roads necessarily cross and recross a myriad of irrigating ditches and laterals which are seldom well bridged. The bridge building is in nearly all cases characterized by an economy of material. The bridges are as a general thing both too short and too narrow and minus railings. The abutments are seldom of a substantial character and the earth about them is gradually eaten away by the action of the water, and the bridge sags unevenly. The approaches also lack proper filling and are both narrow and steep. The culverts across the smaller laterals are usually constructed in a slovenly manner, the plank covering frequently becoming loose and getting askew. The plow and the grader are now used to a large extent on the Colorado country roads, and in time the roads will get properly shaped up and their roughness worn away.

About the mountain roads and trails of Colorado a volume might be written. There are about 70,000 square miles of mountainous territory in the state and nearly all of it is traversed by highways and byways of some kind. Where there are not mines, there are ranches that must have communication with the outer world. The roads designed for hauling from the mines to the railroads or reduction works, are usually difficult of construction, being among the rockiest parts of the mountains and characterized by steep grades. There are stage roads that lead from the foothills far up over the passes of the continental divide, crossing the divide sometimes at an elevation of more than 10,000 feet above sea-level. In many cases these roads are quite crude of construction, but they answer their purpose after a fashion, as the vehicles are light and are seldom very heavily loaded.

In several instances the state has taken hold and constructed both mountain roads and bridges. But, considering all the conditions, the Rocky Mountain road is not so difficult of construction as might be imagined, Of course, curves must be sacrificed to grades. Wide detours are often necessary in order to avoid high ridges and mountain ranges. But, winding through all this immense labyrinth of hills are numerous narrow glades, canyons and gulches that offer an entrance for a highway.

It must be remembered that the mountains are comparatively bare until an altitude of about 10,000 feet is attained, so that timber does not interfere greatly with the construction of roads. The soil of the mountains is much more inclined to sand and gravel than that of the plains, so that, with the grades and the quick-drying sun and air, the roads are seldom muddy. In consequence of the cloud-bursts and heavy showers incident to the Rocky Mountain regions, the roads wash considerably, especially on the steeper grades. The water during one of these sudden and violent storms, pours down the ruts of the road from a foot to two feet deep, cutting deep trenches and laying every boulder bare for the wheels to strike against in passing.

In cases of this kind the usual way is to turn a little to the right or left and beat a new trail. If the road is a county highway the road overseer of the district is liable to call around in a week or two and repair the damages. Of course the sand washed out of these ruts must lodge somewhere, and it is usually carried to the bottom of the hill and deposited there in the roadway to the depth of a foot or more, making more hard travelling.

But the construction of the generality of Colorado mountain roads is a simple affair. A rock rolled to one side here and a root chopped out there, and the thing is done. Sometimes in swinging around the side of a hill, it is necessary to cut and fill, in order to level up the track. And there are instances when way must be made around a promontory of solid rock, and much blasting becomes necessary. But, by blasting on the upper side and filling in the lower with the broken fragments of rock and debris, a pretty good single track is secured. But it would be quite inconvenient for two vehicles to meet in one of these rocky cuts, for they could not pass, and one or the other would have to be unhitched and pulled back to an opening. In the construction of a state road in Lorimer county recently, several of these rocky cuts occur and the road, being too narrow for the passing of two vehicles, turning-out places were blasted out at intervals, so that by keeping a careful outlook ahead the traveller need not be confronted with one of these dilemmas.

The rivers and creeks are, as a general thing, bridged with log or pole structures. In the more populous regions truss bridges with plank flooring are found. The shallow brooklets with smooth, gravelly bottoms are forded. I remember one picturesque piece of mountain road, some two miles in length, that crosses and recrosses the same small stream not less than thirteen times, and each crossing is made beneath an arbor of willow and quaking-asp branches. Occasionally a long, steep hill is encountered, to climb which requires much hard pulling and frequent rests; and to descend which requires the use of stout wagon brakes. And, when brakes are not to be wholly trusted, they are supplemented by a good-sized tree, cut down and tied top foremost to the rear axletree.

Such a hill is Pingree Hill, on the road from Fort Collins to Rustic, in northern Colorado. In a space of two miles there is a sheer descent of twelve hundred feet. The road leads through what some might call a pass or gulch, but it is more like a winding stairway, with now and then a level landing, and then a curving, steep pitch between. Pingree Hill leads down from the summit of what might be called a mountain plateau to the bed of the grand canyon of the Cache la Poudre river, and along this canyon the road continues in close proximity to a stream until it rises over Cameron Pass and descends into North Park.

* * *

The Western Interior Coal Field.

The Western Interior Coal Field lies within the prairie plains of the Mississippi Valley in the states of Missouri, Kansas, Iowa, and Nebraska The coal of Nebraska, however, says Mr. H. F. Bain, in Part III, of the Twenty-second Annual Report of the United States Geological Survey, now in press, is so small in quantity and so irregular in supply that the Nebraska portion of the Western Interior field may be neglected. The total area of the field approximates 66,000 square miles; the probably productive areas are: Iowa, 10,000 square miles; Missouri, 14,000 square miles; Kansas, 15,000 square miles; but the coal of this field is characteristically patchy and irregular in distribution. The usual variation in the beds is from 18 inches to 6 feet: but in some of the pockets coal 70 feet thick has been found.

The development of the coal mining in this field has been determined chiefly by the location of the transportation lines. Thus, in Iowa, the Fort Dodge mining district in Webster County, the Boone County mines, the Des Moines mines in Polk County, the Oskaloosa mines in Mahaska County, the mines from Ottumwa in Wapello County, through Monroe to Cleveland in Lucas County, the mines in Appanose and Wayne counties, and the mines in Adams, Taylor, and Page counties; in Missouri, the mines at Huntsville, Randolph County, the mines at Rich Hill, Bates County, and at Minden, Barton County, the mines in Schuyler, Putnam, and Adair counties, the Lexington district in Ray and Lafayette counties; in Kansas, the Leavenworth mines, the Cherokee coal district in Cherokee and Crawford counties, the mines in Linn, Bourbon, Franklin, Atchison, and Osage counties: these have all been determined by the main east and west railway lines and their branches, the Illinois Central, the Chicago & Northwestern, the Rock Island, the Burlington, the Wabash, the Missouri, Kansas, and Texas, and the Santa Fe.

The coals of the Western Interior field are exclusively bituminous and essentially steam coals. Owing to the irregular distribution of the coal, it is impossible to give any trustworthy estimates of the probable total yield of the field. For the same reason coal-mining machines cannot be used as much here as elsewhere. Mule haulage is most common; there is very little electric haulage in this field. The mines are not deep, and the room and pillar is the usual method of mining.

An unusually large percentage of the mine laborers are English speaking, either Americans or English, Welsh or Irish. In certain camps negro labor has been introduced as a result of strikes. Of recent years Slavs and Italians have been coming into the region. Ten years ago, the miners in this coal field were practically unorganized. From time to time they have become better organized, until now in Iowa the unions are in control of the situation. This close union of the men has, in some particulars, placed the Iowa operators at a disadvantage; but it has undoubtedly been good for the men themselves in many particulars, and good for the trade as a whole in others.

One advantage has been in steadying the trade and in decreasing unfair competition between district and district. A second advantage has been in bringing the operators closer together, with the result of putting coöperation in certain ways in the place of competition. With the thorough organization of both men and operators it seems probable that miners' strikes may disappear, and disagreements be more quickly adjusted. In Kansas and Missouri things are not so well adjusted. Some of the most powerful companies, after a long fight, defeated the union, and made themselves independent as regards time and methods of working. They find their reward for money spent in this act of independence. Mr. Bain thinks that in the two states as a whole, however, the conditions are bad in that they are quite unequal from point to point, and that it is doubtful whether the results have been altogether beneficial to the general public.

There is no apparent reason for anticipating any marked change in the steady development going on in this field. In 1900, 564 commercial mines in 61 counties in Iowa, Missouri and Kansas produced a little over 13,200,000 short tons, valued at the mines at a little less than $16,900,000, of which 33 per cent. was used as railroad fuel, 25 per cent. for manufacturing fuel, and 42 per cent. as domestic fuel. The estimated capacity of the mines in 1900 was over 18,600,000 short tons. The production of this field in 1880 was about 3,100,000 short tons; in 1890, it was about 9,000,000 tons.

Hall's Journal of Health

Founded by Dr. WM. M. HALL, 1854.

THE CARE OF THE HAND.

BY O. B. SALISBURY.

A well-formed and well kept hand is an object of great beauty. It is one of the prominent parts of the body that unmistakably reveals the characteristics of the individual. Those who are careless of their hands are often negligent and unreliable in other things, and dirty and ill-kept nails show directly a want of culture. A really beautiful hand is rarely seen; yet departures from the type are necessary to give it character. Women especially cannot be too particular about their soft skin that makes the touch of the hand so soothing to the brow, so eloquent of sympathy, and therefore so inspiring to the tired hand which it clasps with helpful affection. The beauty of the face is often marred and spoiled by the hands when they are rough, red, and ill-kept.

The hand consist of the wrist or carpus, the broad portion or palm formed by the metacarpus and its coverings; and of the five fingers, the first of which is called the thumb. The skin of the palm is hairless and marked by various folds to which in palmistry much importance is attached. It is firmly adherent to the subjacent fascia. On the thumb side the palm presents the ball or thenar eminence, and on the opposite side the hypothenar eminence, On removing the skin, the palmaris brevis muscle is seen on the inner side, and elsewhere a dense layer of fat, with some small palmer branches of the median and ulner nerves. Beneath these, the strong palmar fascia, into which the palmaris longus muscle is attached above, appears with the transverse ligament at the roots of the fingers. Immediately beneath the palmar fascia is the superficial palmar arch of the ulnar artery, the arch being completed by the superficialis volae branch of the radial, and branches of the median and of the ulnar nerves. The skin of the palm is very sensitive and well supplied with sweat glands, oily glands being absent.

Although not so exposed as the face, the hand has to come in contact with all kinds of things that tend to soil the skin; consequently, the keeping of the skin white and clean is rendered more difficult. The amount of care to be bestowed upon the hands depends so much on the kind of labor done that we can only lay down general rules, for the guidance of those who wish to keep their hands beautiful.

There is nothing which causes the skin to look red and rough sooner than the frequent dipping of the hands into cold water, and not drying them thoroughly afterwards. They whose occupations render this necessary should make it a rule to dry the skin perfectly with a soft clean towel after each time it has been wet. When doing any rough work, which is likely to soil the hands, wear an old pair of gloves. The gloves should be loose, for nothing so disfigures the hand as a tight glove, which lessons the blood to the skin, making it white, besides cramping and deforming the finger portion.

For washing the hands always use warm water, and a good-sized brush with medium bristles is absolutely necessary for those parts of the hand where dirt may collect. Ink stains and rough skin should be carefully removed with pumice stone while the hands are wet, taking care not to scratch the nails. A tablespoonful of prepared almond meal placed in the water is a good method of rendering the skin soft. As regards irritating soaps, we have mentioned before, a good superfatted soap is the best. If the skin is red and rough, the daily use of cold cream, after washing, is recommended, and the hands afterwards dusted with violet powder. A soft rough towel will be found best for drying the hands. A good application to whiten the hands is made by dissolving—

Powdered borax	1 dr.
Glycerine	1 oz.
Rose water	2 ozs.

To be rubbed on after washing, and before drying the skin.

Chapped hands and chilblains are among the minor winter discomforts caused by cold and damp weather. The chaps are formed by the scarf skin, or thin outer cuticle, becoming hard and inelastic which causes it to shrivel up and expose the sensitive skin underneath: this soon becomes inflamed, cracks and bleeds. If nothing is done to check it, the parts become very sore and painful. A delightful application for chapped skin may be made as follows:

Glycerine	2 drs.
Cold cream	2 drs.
Lanoline	½ oz.

Mix.

It should be remembered that chapped hands are much easier prevented than cured. The first precaution necessary is to wash the hands in warm boiled or filtered water only, if possible, and take care to thoroughly dry the skin, especially the back of the hands and wrists. Before drying, rub them over with the above mixture, then thoroughly wipe until quite dry. Wear long gloves (leather is preferable to wool) that will cover the wrists by two inches, and always have the hands covered before going out into the air; avoid exposing the skin to the cold atmosphere for even a few minutes. Then, the last thing at night a small quantity of the cream should be well rubbed all over the hands and wrists, wearing, if possible, a loose-fitting pair of soft suede or chamois gloves to protect the bed linen, or the superfluous cream may be wiped off with a towel.

Chilblains first appear in the form of a redness or bluish tinge of the skin, more or less swollen, accompanied by heat and itching. This inflammation may develop into a blister, which often breaks, forming a troublesome sore. As their name implies, chilblains are caused through a chill of the skin, which retards the circulation and with the corresponding reaction the blood is forced into the shrunken vessels causing the inflammation. Therefore, to cure the chilblain, we must restore the circulation by rubbing the hands. Those who are easily susceptible to cold suffer most from chilblains, while others escape even without gloves. Camphorated soap liniment is an excellent application. When broken, they should be kept covered, and a dressing of zinc ointment will be found to heal them.

Warts are a great disfigurement, especially when they make their appearance on the hands They are formed by a cluster of papillæ, which commence growing to an abnormal size, carrying the scarf skin by which they are covered with them, and also produce a conglomeration of cells that form the top of the wart. They are the common variety, seed wart, filiform wart, flat wart and mold wart. To take warts away, the only effective method is by cauterization. A simple painless method is to first pare away the hard skin, and use the following application with a camel's hair brush morning and evening:

Salicylic acid	15 grs.
Collodion	2 drs.

and scrape off every day or two after it is applied, until the whole of the wart disappears.

Insomnia.

Every cause capable of increasing the amount of blood ordinarily circulating through the brain has a tendency to cause wakefulness. If the brain is often kept for long periods on the stretch, during which the vessels are filled to repletion, they cannot contract even when the exciting causes cease. Wakefulness, as a consequence, results, and every day the condition of the individual becomes worse, because time brings the force of habit into operation. Everything that tends to throw the blood unduly to the brain, or to accumulate it there, should be avoided. This is a vital matter, and prevention is better than cure.

Tight or ill-fitting articles of dress, especially about the neck or waist, and tight boots and shoes, should be discarded; the feet should be kept warm so that the circulation may be promoted. Wearing cork soles in the boots or shoes and changing the socks every day are excellent means to this end and strongly recommended. Apart, however, from physical causes, there are various moral causes acting on the brain equally inimical to sleep—whatever keeps the attention fully aroused keeps the blood-vessels of the brain distended, and the consequences of that we know. On the other hand, when the attention begins to flag the tendency is for the vessels to contract and for sleep to ensue.

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SCIENCE AND EDUCATION.

One of the most gratifying features of public school education at the present time is the marked tendency toward scientific subjects. Up to ten years ago few teachers were prepared to impart knowledge to their charges above a very elementary smattering of "natural philosophy" and physiology; very seldom chemistry. Physics is now recognized to be the most valuable subject with a practical end in view that is taught in our higher schools. All the engineering professions, whether civil, mechanical or electrical, are applications of the fundamental laws or principles embodied in physics.

It is well to consider the great benefits mankind derives from the results of modern engineering; our elegant railway service, the time-saving and convenient telephone, the electric light, our ocean cables and telegraph service, whereby happenings in Paris or London are made public in New York as easily and as quickly as if they were but ten miles away. All these wonderful things and now the remarkable Marconi system of telegraphing without wires, are simply physics put to practical use; applied science.

While chemistry and many other branches of science have been the means of adding to our comfort and welfare, physics must be conceded to have already done more, and is likely to do more for us than any of the others. We therefore readily see how valuable a scientific education really is, and how necessary for the young of our schools to be given the opportunity of such a course of study.

Although thousands of young men graduate from engineering institutions every year, all find lucrative employment at once, many of them actually engaged by large firms and corporations before graduation. Applied science is advancing in rapid strides, but even now comparatively few among the general public realize its far-reaching effects.

THE HEAVENS FOR APRIL.

BY PROF. MALCOLM McNEILL.

Constellations seen on April evenings are on the whole not as fine as those seen either in the winter or in the summer. The finest of the winter groups are below the horizon or too low to be conspicuous, and the more striking of the summer constellations are not yet above the horizon far enough to be noticeable. Ursa Major is on the meridian between pole and zenith. Cygnus has just risen a little east of the north point, and Lyra is also low down in the northeast. Hercules is rather higher and nearer east. Corona and Bootes are above the latter, Bootes, with its first magnitude star Arcturus, being the most striking group in that part of the sky. The ecliptic constellations in sight are Libra rising a little south of east, Virgo, above and farther south, Leo on the southern meridian, Cancer and Gemini in southwest, and Taurus low down in the west. No prominent groups are in the southeast below the ecliptic. Orion and Canis Major are setting in the southwest and Canis Minor is somewhat higher up. Auriga is above Taurus and Perseus is rather low in the northwest.

Phases of the Moon, Eastern time:

Last Quarter,	Apr.	1,	1 h. 24 m. A M.
New Moon.	"	8,	8 h. 50 m. A.M.
First Quarter,	"	15,	12 h. 25 m. A M.
Full Moon,	"	22,	1 h. 49 m. P.M.
Last Quarter,	"	30,	5 h. 58 m. P.M.

There will be two eclipses during the month, a partial eclipse of the sun on April 8, and a total eclipse of the moon on April 22. Neither of them will be visible in the United States. That of the sun is very small, the maximum obscuration being only one sixteenth of the sun's diameter, and it can be seen only in far northern latitudes. The eclipse of the moon will be visible generally throughout the eastern hemisphere. These eclipses with a third, another partial eclipse of the sun on May 7, are of interest chiefly as an example of eclipse triplets, which happen occasionally. Such cases are always like the present, a total eclipse of the moon in the middle with partial eclipses of the sun about a fortnight before and after. The last occurrence of the same kind came in Dec. 1898 and Jan. 1899. The moon eclipse is always total and both sun eclipses partial. The motions of the sun and moon do not admit of a total eclipse of the sun with eclipses of the moon at both the preceding and following new moons, although in perhaps the majority of cases there will be one eclipse of the moon either two weeks before or two weeks after a solar eclipse.

April, 1902, is a very poor month for evening observation of the planets. During the entire month not one of the naked eye planets is above the horizon at nine o'clock in the evening. Neptune alone of the large planets is in our range of vision at that time, and it is too faint for naked eye vision.

Mercury is a morning star until April 28; but it rises on April 1 only about three-quarters of an hour before the sun, and this interval steadily diminishes until it passes conjunction with the sun on April 28. It then becomes an evening star, and will become visible in the evening twilight early in May.

Venus is also a morning star, rising about two hours before sunrise throughout April. It reaches its greatest west elongation on April 23, and is then 46° from the sun; but as it is 17° farther south, the interval between the rising of the sun and of the planet is much less than it generally is at time of greatest elongation.

Mars passed superior conjunction with the sun on March 29, and is now a morning star, but even at the end of April it rises only about a quarter of an hour before sunrise.

Jupiter and Saturn are also morning stars, and they are far enough away from the sun to be well seen in the early morning hours. By the end of the month Jupiter rises at about 1.30 A.M., and Saturn is an hour earlier. Both planets move eastward in the constellation Capricorn, the former about 4° and the latter about 1° during the month. The apparent distance between the planets will increase until July. Then their retrograde motions will cause a small diminution which will last until October. They will then be about as near together as they are in April.

Uranus rises at a little after midnight on April 1, and two hours earlier on May 1. It moves about half a degree westward during the month in the southern extension of Ophiuchus between Scorpio and Sagittarius. At the end of the month it is a little less than 1° north of the fourth magnitude variable *b* Ophiuchi.

Neptune is in the extreme western part of Gemini, and is above the horizon until late in the evening.

◆

Hydrogen a Compound.

Scientists now find the atom a compound, and they are studying its thousandth part. Prof. Pickering, of Harvard, as the result of an intricate study of the spectrum of lightning flashes, has come to believe that hydrogen, instead of being a simple element, is made up of at least three components. This and other recent discoveries lends new probability to the old theory that the chemical elements are not fundamental, but that they themselves are made up of various primary simples combined in their different proportions.

◆

Growing Tomatoes.

Tomatoes have been grown continuously for eight years on the same plot of ground at the New Jersey Experiment Station farms. The only fertilizer used has been stable fertilizer at the rate of twenty tons to the acre, annually. The yield up to the last has been perfectly good.

Correspondence

An Ingenious Spider.

Editor POPULAR SCIENCE NEWS:

Some years ago while crossing a pasture field in western New York, my attention was arrested by what seemed to be a large, variegated flower of about three inches in diameter in a tuft of grass. The slanting rays of an afternoon sun, on a bright August day, caused it to sparkle with a variety of tints, making it an attractive flower to the eye.

On close inspection I was astonished to find it an artificial flower, and the artificer and inventor a spider of the funnel web weavers, the Agalenidæ family.

This spider had woven a regular funnel web three inches in diameter, and four inches deep, with an aperture at the bottom of about five-eighths of an inch in diameter. The petals of the flower were made of the wings of insects she had entrapped in her web and eaten; and undoubtedly the idea of converting the funnel into a flower was an after-thought, as all the parts of the flower showed plainly that they had been added to the original structure. There were in the outer circle of artificial petals seven wings of Piera rapis (cabbage fly). The second circle of petals was in cotinuation of the first, and made out of the bright, and redder wings of other insects. There was a third circle of petals of still smaller wings, but including a greater variety of colors than either of the other two circles of petals. The second circle of wings used for petals included eleven; and the third circle contained seventeen wings. The arrangement of every wing was such as to secure the best exposure of its colors, and that made a proper blending of colors to stimulate a flower almost as perfectly as human skill could do it.

A careful and thorough study of the structure fully convinced me that it was in every one of its many details a work of intelligent design. There was not discoverable a single feature of accident about it. The wings used for petals were arranged according to size first, and next their colors. They were securely bound in their positions by lines of web that passed around them and were made fast to the original web.

The spider, the female, remained at the bottom of the web. She could not be lured to the top of the web except by dropping some insect upon it, when she would come up and securely fasten it by passing lines of web around the insect and fastening them to the structure of the funnel below the petals of the flower. I dropped a number of insects into her web, and each time she repeated the operation of securing them; but did not eat any of them while I watched her. After she made one of the insects fast she would immediately retire to the bottom of the web.

Directly under the opening of the web, at the bottom, there was a large quantity of the remains of insects upon which she had fed. Among the lot I discovered many times more wings of butterflies and other insects than she had used in making her artificial flower. She had evidently selected the ones she used with care in respect to their size and colors, for these features were prominent in the structure.

After a long and minute study of that artificial flower-web, I left it with the conviction that it was an ingeniously designed means of the more readily luring the prey into the web; and much reflection upon it since, and even the failure to have ever found another such instance, have not shaken my conviction of it being a work of design.

A. N. SOMERS.

How Insects See.

Editor POPULAR SCIENCE NEWS:

I am sure that we all understand something of how we ourselves see. We know that our eyes are like little photographic cameras, with sets of lenses, stops to cut off unnecessary light, arrangements for focusing, and everthing else that is needed to form a little colored picture on the sensitive retina at the back of the eye. The eyes of all backboned creatures are, indeed, so much like cameras, that photographs have actually been made with the eyes of some of the large domestic animals.

But anyone who has watched insects at all must have noticed that their eyes are very different from our own. For, in the first place, each eye is often larger than all the rest of the head. There is no iris, and no pupil. Then, too, an insect does not have to turn his head and look straight at anything, as we do when we wish to see clearly. But one of the first things that we notice about an insect's eye is, that it is cut up into hundreds of little surfaces or facets, or is, as we say, "a compound eye." Now each of these facets is at the end of a little tube with blackened sides, filled with a clear jelly, and the entire eye is built up of these little tubes side by side.

It can be easily guessed that an eye so very different from ours must work upon a very different principle, and this is really the case. For an insect's eye is not a "camera eye," like our own, but what is called a "mosaic eye," after the pictures which are made by putting together little bits of colored glass and stone. We can get an idea of how this sort of eye acts if we look through a small roll of paper. When we do this, we see only the spot at which we point the tube.

Now the insect's eye is like a large number of such tubes put together into a ball. The owner looks out through all the tubes at once, and sees the spot at the end of each, here a bit of green and there a bit of red, it may be. Thus the animal with his two eyes looks in all directions at the same time, and sees as many spots of color as there are tubes in both eyes,—several thousand, perhaps, all combined into a single picture like a pattern worked in worsted.

It is not easy to imagine how the world appears to an animal with a compound eye. Think of flying through the air and seeing the four walls of a room, the floor and ceiling at the same time, and all equally well. This is where the insect has the advantage of us. We, on the other hand, though we see only a small space at one time, see that little far more clearly than an insect ever sees anything. To a dragonfly, this page would be only a gray blur, about as indistinct as it is to us ten feet away. It is well known, also, that an insect does not fly through white netting against a dark background, even though the meshes be several times larger than his body. To him it all seems to be a gray surface like the tints in an engraving or half-tone picture.

We may get some idea of an insect's power of sight, if, while looking straight at some object, we notice what there is at the sides as far around as one can see. Do you not make out that you see shapes only dimly, but that you can see colors perfectly well, and that you can see something moving almost behind your head? An insect seems to see every object as we see one thing when we look at another. It sees shapes vaguely, but colors perfectly well, and knows at once if anything near him moves.

It appears, however, that the compound eye is good only for seeing things at a distance, and is not of much use at short range. So nearly all insects have one, two or three little eyes, which, so far as can be made out, are to help them see things near at hand. These ocelli, as they are called, are somewhat like our eyes, but much simpler, and they appear as minute dots on the front of the head between the compound eyes. How much an insect sees with these ocelli, no one really knows. But if we watch one and notice how much he seems to depend on the sense of touch in his antennæ, I think it will be agreed that he acts more like a blind man feeling the ground with his stick, than like a being who sees clearly as we do.

E. T. BREWSTER.

Cause of Night Foam.

Editor POPULAR SCIENCE NEWS:

In response to query on "Something About Foam," in the correspondence column of the February number, the writer begs to submit the following as explaining to a great extent, if not wholly, the facts.

At night, in the valleys especially, the cool, humid and still condition of the atmosphere is such as to hinder evaporation of the water in the film composing the bubbles of the foam, which is so easily formed in turbulent streams; but with the rising of the sun the circulation of the air begins, the humid vapor blanket is dissipated, the temperature rises and all tend to promote evaporation which causes rupture of the bubbles and the foam gradually disappears. CHAS. M. PALMER.

Collecting of Foam.

Editor POPULAR SCIENCE NEWS:

J. Mayne Baltimore wants to know why foam collects in night and disappears in the daytime. The water of streams contains more or less vegetable matter in solution. In passing obstruction when the water is thrown into violent agitation, air becomes entangled in the water on account of this vegetable matter in solution. The surface tension on the film surrounding the corpuscle of air, holds it imprisoned until evapovation liberates it. This imprisoned air is held longer in the night on account of the slow evaporation.

When the sun rises in the morning, the extra heat shed abroad from the heavens soon tells upon the foam masses collected near the agitated waters, dissipating them more rapidly. Here in Florida, one may see bunches of foam floating down the Suwannee river soon in the morning, having collected at the various obstructions in river, sailing away in long procession down stream. Go back to the river bank after sun is up awhile and it will have disappeared.

C. T. MCMONNEN.

Chipmunks Defended.

Editor POPULAR SCIENCE NEWS:

On page 52 of your March number of POPULAR SCIENCE NEWS I read "no wicked chipmunk would dare venture out so far to rob the nest of its four or six white eggs, with their pretty irregular spots and lines." I can never read or hear of any of my pets being maligned without raising a protest; and I wish to affirm that the chipmunk (Tamias lysteri) is strictly a vegetarian at all times, and could have no possible use for eggs. He, with his cousin, the gopher, and the woodchuck, are all ground rodents and very poor climbers. The chipmunk, on some trees, will ascend a few feet only. I only wish to defend the "wicked chipmunk" from accusations of unnatural propensities.

F. B. HALL.

Climate of Western Europe.

Editor POPULAR SCIENCE NEWS:

In September number of 1901, was a short item saying that certain meteorologists claim the old theory of Gulf Stream moderating climate of Western Europe to be a "myth." I am much interested. Could you have one of the meteorologists explain his theory in your columns, or could you tell me to whom I could write for information? D. W. S.

Food and Blood.

Unless the food is prepared in a wholesome, palatable manner, it cannot be converted into good blood

Questions and Answers

QUESTIONS NOT ANSWERED.

Answers are solicited, especially for all questions so far without replies. Questions will appear but twice, successively. Those unanswered will then be designated by numbers. The following, need reply —297, 309-11, 318, 330, 333, 337 8, 342 3, 350.

333. Multiple Telegraphy. How can two or more operators use the same wire? I can conceive that many systems of waves can be simultaneous, but how about the mixing up of dots and dashes received?

WILLIE.

337. Permanent Marking Ink. Could you oblige me with the name of a permanent marking ink for use with a rubber stamp on linen; I have tried several, but they have all been failures. W. S.

338. Boric Acid in Food. How can one who is not a chemist detect the use of this as a preservative of food? HYGIENE.

342. Prof. Matthews and Loeb's Theory of Nerves. As stated in the papers, a part of the new theory is that the less solid components of the nerves and muscles are stiffened or gelatinized with every excitation. How about this when the action is rapid? Would there be 727 trillions of stiffenings (and by inference as many liquefactions or relaxations) per second when the optic nerves receive waves of violet light, this being the rate number of that color? INQUIRER.

343. Song Birds Talking. In Science, Jan. 31, a lady correspondent of Bird Lore is soberly quoted as reporting that a wild Rose breasted Grosbeak was heard by her repeating the words "You are a pretty bird,—where are you?" and "Pretty, pretty bird, where are you?" The article gives other surprising statements. What do your readers know about birds literally and unmistakably talking? I never heard any do so except parrots. SENEX.

350. Regarding a Leaky Faucet. There are two faucets at the kitchen sink—one for hot water and one for cold water. Recently the packing of the hot water faucet became defective, causing a drizzling nearly all the time. One would naturally suppose this leakage to be the most when the pressure is the greatest, but experience shows that it is exactly the reverse. There is only a drip, with now and then a very small stream, from this hot water faucet, when none in the house are in use. Upon opening the cold water faucet at this same sink, or either the cold or the hot water faucets in the bath room on the second floor, or one or more of the two cold water faucets and the two hot water faucets in the laundry tubs in the basement, then this dripping or drizzling stream from the defective hot water faucet in the kitchen becomes quite a large stream. Of course the pressure must be the most intense when water is not running from any other faucet in the house. Why is it that the hot water passes this defective packing in greatest volume when the pressure, as explained, is the least? E. F. B.

352. Subconscious Invention. The Weltermists in this section take great delight in pointing out that Edison always solves his problems and inventions practically while asleep; i. e., holding that invariably the solution of difficult points is done by the unconscious mind. Is there any foundation for such a statement?

DALLAS, OK.

355. Fireproofing Wood. What is the cheapest and readiest method of rendering wood practically fireproof?

CARPENTER.

356. Heating Water in Quantity. Is there any domestic way of heating a boiler-full of water, or a large panful, without making a kitchen-range fire? S. L.

357. Field Larks and Grackles in Winter. Is it common or rare to see Field Larks (called Meadow Larks) and the Purple Grackle in mid-winter as far north as the latitude of New York? SUBURB.

358. The English Sparrow vs. Other Birds. How is it that the English Sparrow is said to drive away other birds? I have watched birds for years and have never seen the English Sparrow molesting other birds, but rather, as this winter, mingling in a friendly way with them, apparently delighted to have their company.

SUBURB.

359. Incandescent Lamps. Do incandescent lamps increase in candle-power, and for what length of time, before they decrease? J. S. S.

360. Tarnished Brass-work. How can the old lacquer be removed and tarnished lamp fixtures be restored to original brilliancy? What lacquer is used?

J. S. S.

361. The Red Spot on Jupiter. Is it really permanent and stationary, and what is it supposed to be? X.

362. A Silhouette Party. How is this arranged and conducted? I have seen it mentioned. J. KNIGHT.

363. Hydrogen. Is there any substance or salt that contains more hydrogen than water? Can it be obtained in any other way than by electrolysis, i. e., taking the oxygen from the water by means of an electric current? CONSTANT READER.

364. Bleached Photographs. Is there any way of reviving bleached photographs? It seems to me I have seen a formula to this effect, but cannot recall the place.

F. SMITH.

365. Luminous Paint. I should like to be informed as to the best formula for making a good luminous paint. Can any one reply through these columns?

R. H. S.

ANSWERS.

321. Sound of Steam Pipes. The "water-hammering" in steam pipes is more annoying than dangerous in dwelling houses. But in establishments where there is a high pressure of steam, the hammering (well explained in your March number by Mr. Thos. M. Muir) is a subject that carries a serious warning.

At a recent meeting of the Manchester Literary and Philosophical Society, England, Mr. C. E. Stromeyer read a paper on "Explosions of Steam Pipes Due to Water-Hammers," dealing with the subject from a theoretical and practical point of view. Referring to the reports of the Commissioners of the Board of Trade, according to which about fifty steam-pipe explosions have occurred from the above causes during the last seventeen years, and that the majority were brought about by the opening of drain-cocks of steam-pipes in which water had accumulated, while a few were clearly due to a plug of water having been shot from the boiler-ends of the pipes to the engine-ends, Mr. Stromeyer first investigated the pressure which is set up when an elastic body suddenly comes to rest, the solution of which problem was correctly guessed at by Dr. A. Ritter in 1889, but he was unable to give a proof of the possibility of discontinuity of motion, which is part of the phenomena of an elastic blow.

This point was gone into by Mr. Stromeyer, and illustrated by means of an unloaded helical spring. Having established this theory, it was easy to see that when an elastic prismatic body is moving axially its front surface comes to rest instantaneously on contact with an immovable obstacle, while the more distant part of the bar comes to rest also instantaneously when the wave of pressure or of change of velocity reaches them. This wave travels with the velocity of sound, and as the tail end of the bar has maintained its velocity it is quite clear that the axial pressure in the bar is the product of the elasticity of the material into the ratio of the velocity of the object to the velocity of sound. With the help of this theory it was easy to calculate the pressure which a plug of water of a given length travelling a given distance under the influence of a given pressure will exert if brought to a full stop. This was illustrated to the meeting by the bursting of two glass tubes by means of the water-hammer. A novel experiment was also made, showing how violent are the concussions set up even in a small glass tube if the water which was originally contained therein is drained off while under steam pressure.

E. Mechanic.

326. Weather Forecasts. Why is it that so many official forecasts fail? An answer to why so many of the government weather forecasts fail is found in the article in the Year Book of the Department of Agriculture for 1900. It is written by Alfred J. Henry, Professor of Meteorology Weather Bureau. He says "The time at the disposal of the forecast official of the Weather Bureau at the central office at Washington city, for forecasting probable weather changes, cold waves, and severe storms, is about thirty minutes in the morning and forty at night. It is impossible in this short time to do more than express the character of the anticipated changes for each state or district east of the Rocky Mountains in any but the most general terms. * * * Persons who use the forecasts constantly should cultivate the habit of carefully noting the weather changes in their respective localities, especially the sequence in which such changes occur, for it is only by acquiring a knowledge of local weather signs that they can use government forecasts to the best advantage." There is less liability to mistake in regard to state or district officials, because they have more time to amplify the general reports.

G. Bogart.

331. Animals as Weather Guides. An experience of many years has taught me that it is true to a certain extent of stormy weather only, and particularly of northerly or easterly winds. The coats of horses and cattle are electrically affected, and the curry-combing of horses when a brisk north or northwest wind is blowing in winter, will excite the animal. I said to a certain extent, for the symptoms of uneasiness do not arise at a period long antecedent to the storm, and there is even a great difference in animals, as to their sensitiveness. P. G

336. Worn Eyeglasses. Something could be done with "jeweler's rouge" (fine iron-peroxide), but the optical curvature of the glass might be injured by too much rubbing. Glasses of very serviceable quality are not costly. Care should be taken that good eyeglasses do not suffer by friction with anything. Experience.

339. Spiders Neck and Wasp's Food. In popular writing a man may speak of catching a big spider by the neck, meaning just at or near the cephalic region, though every one ought to know that the spider's head and thorax are not separate. As to wasps eating animal as well as other food, it would seem to depend on the kind of wasp, for authorities speak of some of them as carnivorus. Edwin.

340. Scientific Names of Species. The specific names are often the Latin or Greek equivalents of the English names, —thus Seiurus auricappillus (the Golden-Crowned Thrush). If one is ignorant of the ancient classic languages, he nevertheless will soon learn that the components of auricapillus mean gold and head; and so with a multitude of specific names in which words of classic derivation are frequently recurring. Thus, among the sponges, Hyalonema is easily recognized as meaning glass thread; we often have like derivatives, even the English word hyaline, and the nema in the name of thread-worms, Nematelminthes. Euplectella speciosa, (the flower-basket sponge) one soon understands as signifying *eu* (well) plectella (woven, plektos) with diminutive termination. So the name of the Tree Sponge, Cladorhiza—sometimes misprinted as rhinza—is recognized as made up of two components often met with, meaning branch and root,—the rhiza occurring in Rhizopods, root-foot, a class to which Amœba belongs.

The use of names in scientific forms fixes the name as English words would not. People are constantly applying the same descriptive English names to very different species Thus "Black-headed" is applied to at least a half-dozen of our birds, but the scientific names of these, even when referring to this feature, are distinct. Better do some studying in language and pronunciation rather than be involved in a confusion of English names. Edwin.

341. Licking Postage Stamps. J. H. may have escaped contagion, but what is the need of applying the tongue to a postage stamp? The finger can be wet for this purpose, and if you have ten letters to stamp, use your ten digits successively. Post office clerks invariably shove out stamps with the gum side downward on the board which has been pawed by countless hands, clean and unclean. There should be a Board of Health order to correct this practice of the stamp sellers.

R. C.

344. The Uses of Italics. This may be illustrated by zoology. In reference books, it is important to print genera and species in italics, so that the searcher's eye may catch at once what he is looking for. But in popular science there is no such reason; and the practice is a vestige of the old idea that scientific names (usually compounded from Latin or Greek) must be italicised because we italicise phrases from other languages. In ordinary writing, italics are very rarely necessary, and should be used only when unavoidable to make the sense clear. It is a juvenile and especially a feminine crudity to be underscoring words on all occasions. It is a kind of screaming. Common Sense.

353. The Wireless Telegraph Over Land. This is just as possible as over sea; and, moreover, it can also be through land, as experiments have proved. We hear of many cases where electric signaling through the earth has been accomplished.

Reader.

354. The Origin of Rock Oil. It is known to geologists that rock oil can be traced to beds of bituminous shale as its source, wherever it has been investigated in this country. How far the bitumen of the shale was vegetable, animal or chemical, each or all, in its origin, is an open question. Beds of bituminous coal are similar, without the mud element that forms shale, and are referred to vegetable origin, like any coal. Slight exceptions are animal fossils that sometimes contain bitumen. Geolog.

CURRENT NOTES.

The Passing of "Central."

A very significant innovation is a telephone system that does away with "Central." In practicable and successful operation in Fall River, Mass., is a telephone exchange providing an automatic arrangement whereby the subscriber, by revolving a disk—somewhat like the disk of a combination safe—until it checks off the number he wishes to call for, "rings up" the number. Bringing the "combination" to the first number in the series he wishes causes a switch in the "Central" exchange to swing to a certain group of contacts; the next number narrows the selection to a certain number of contacts in the group; the last brings it to the identical spot required. The caller then pushes a button and the connection is established. If the line is busy, a buzzing noise gives him warning. The calls come in first to the larger trunk lines, of course, and thus it might be expected that the apparatus would be often busy, since one call would shut off accessibility to many numbers in the group of instruments covered by the trunk line, but an ingenious contrivance causes the current to pass by the trunk lines that are busy till it comes to one not in use, so that the system would fail to work only when all the trunk lines of selectors were busy. Even then the buzzed warning would indicate that the caller would have to wait only until one of ten persons had finished talking.

The cost of maintaining the mechanical part of the system has not increased. And though it works hardship to discharged employees, the system economizes in wages, for, with the exception of necessary bookkeepers and a few attendants to see that things run on without hitches, a force of work people is not required. Indeed, on Sundays and during the night while the exchange is locked, the instruments continue making their connections without supervision. Privacy is secured. Cheapness is secured. The automatic telephone means another step in the elimination of middlemen and the automatizing of life.—World's Work.

The English-Japanese Treaty.

The recent treaty between England and Japan for the purpose of maintaining the integrity of the Chinese empire, in all probability transcends in importance any other one event that has happened for a long time. It acts as an efficient check to the aggressive policy of Russia in eastern Asia and assures the continuance of the open door policy by the Flowery Kingdom.

It has been hinted that the United States is a party to this compact between England and Japan; while this is not actually so, there is no doubt that this alliance for peace has our moral support. In fact, our moral support is the only thing that makes this alliance as effective as it is.

A Statue of Professor Haeckel.

News comes from London that Prof. Haeckel, the eminent author of "The Riddle of the Universe," has consented to sit for a statue to Prof. Harro Magnussen. The Athenaeum states that the statue will probably be placed in the Zoological Gardens at Jena. One of Prof. Haeckel's friends bequeathed 60,000 marks for this purpose several years ago.

Method of Etching Pictures.

An artist of Philadelphia is the inventor of a device which has been recently patented, by which works of art can be produced by anyone without any previous tuition or particular aptitude for handling the pencil. The instrument is called the etchograph. On the top plate of a tripod, a support is carried, comprising a longitudinal bar and a lateral bar. At one end of the longitudinal bar is carried an adjustable frame to receive a glass plate coated with a transparent film of gelatine or collodion; at the other end, the bar is formed with a slot to receive a holder for a vertically adjustable lens. The lateral bar serves as an arm-rest. The tripod having been set up in proper position, the engraver looks through the lens, and sharply focuses the image transmitted through the glass plate by sliding the holder in the slot of the longitudinal bar. The reduced image, being apparently projected on the plate, can then be engraved on the prepared surface of the glass. By this means anyone can make a satisfactory picture without the least knowledge of art or even acquaintance with the use of the pencil; but with the skill which soon comes of practice and observation. some very artistic effects can be obtained.

School for Wireless Telegraphy.

The Marconi Wireless Telegraph Company, of London, England, has opened a school for the teaching of wireless telegraphy at Frinton-on-Sea, in Essex. The school consists of two villa residences fitted with all the necessary instruments and a 165-foot mast. It is in communication with the station at the North Foreland, about 40 miles away, and also with La Panne, on the Belgian coast, 80 miles across the North Sea. The Marconi works at Chelmsford are only 20 miles distant, and after completion the instruments are sent down to Frinton and tested between those two points.

Another Pole-Hunter.

Capt. J. E. Bernier, a Canadian, is planning a very systematic search for the north pole. He will start in the summer of 1903, and expects to stay four years in the Arctic regions. His idea is to let his vessel drift to about 150 miles from the pole, and then make a dash for that object in a combination motor-car and boat. A novel part of his plan is to maintain communication with civilization by means of wireless telegraphy.

BOOK NOTICES.

Field Operations of the Division of Soils, 1900 (second report), U. S. Dept. of Agriculture. By Milton Whitney, Chief. Pp. 473. Comprising reports of sixteen sections of the U. S. selected for field operations, fifty-one clear half-tone plates, and forty-seven text figures. The volume is accompanied by twenty-four soil and other maps in separate portfolio. With the recent development of new agricultural areas, and competition in the markets of the world, it has become necessary to consider every factor influencing yield and quality of crops. For these reasons the report of the Division with the carefully collected data is of value, the soil in portions of ten states having been surveyed and mapped.

Prolegomena to Future Metaphysics. Kant. The Open Court Publishing Co. Paper; price 50 cents. This little volume is offered to the public as a useful aid to the study of philosophy. It contains an essay on Kant's philosophy, and selections from representative histories of philosophy which are well calculated to aid one in the study of this subject. The book contains a facsimile of the title page of "The Critique of Pure Reason," portraits of Kant and Grave, and an autograph letter of Kant's.

Discourse on Metaphysics; Correspondence with Arnauld; Monadology. Leibniz. The Open Court Publishing Co. Pp. 272. Price 35 cents. A very lucid translation by Dr. Geo. R. Montgomery, instructor in philosophy in Yale University. These three treatises give a very clear survey of the development of this old time philosopher's genius, in its origin, its growth and its final form. The Monadology has never before been translated into English.

Market Classes of Horses, Bulletin No. 37. By George M. Rommel, B. S. A., Bureau of Animal Industry, U. S. Dept. of Agriculture. Pp. 32; eleven plates; paper. Gives primary considerations of the market, discusses the passing of the street-car horse, the bicycle and electric carriage, causes of present scarcity, horses for draft, harness and saddle. Facts concerning various breeds of horses for all purposes from business to recreation are given. The work is of interest not only to breeders, but to horse lovers as well.

Nature's Portfolios. A portfolio showing the fascination of real wild life and the latest achievements of nature photography. The pictures include live birds, animals, fishes, and insects, and are the best work of men like A. Radcliffe Dugmore, W. E. Carlin, A. G. Wallihan, Herbert K. Job, and L. N. Brownell. The text will be by Mr. Bailey, editor of "Country Life in America." The work will shortly come from the press of Doubleday, Page & Co.

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Locomotive Oiling Device.

Consul R. S. S. Bergh reports on a new oiling apparatus now in use in Sweden, as follows: A Swedish invention which ought to have a good future is the system of oiling piston rods, cylinders, slide rods, and slide guides on locomotives, has been invented by T. F. Malmros, of Gothenburg, locomotive engineer on the state railroads. Formerly, cylinders and slide guides have, at best, received necessary lubrication from the central steam-lubricating apparatus, but piston rods and slide rods with packings have been lubricated by means of old-fashioned oil cups with wick feed, which method, for many reasons, has proved unsatisfactory—especially when metal packings are used.

Mr. Malmros, by introducing the intermixed oil and steam, coming from the central steam-lubricating apparatus, through glander bushings expressly constructed for this purpose, has effected a good and economical lubrication of packings and rods, as well as of the cylinders and slide guides. The system has for five years been tested on one of the express engines of the state railroads—used for the fastest train in Sweden, with a speed considerably exceeding 60 kilometers (37 miles) per hour—and with such good result that all locomotives of the state railroads will be provided with the same. The state railroads have also applied the new lubricating system to a number of old locomotives.

◆

New Alkaloids in Tobacco.

A. Pictet and A. Rotschy reported to the Paris Academy of Sciences that they have found a series of new alkaloids in tobacco. The first of these was a liquid—nicoteine; the second, a solid, nicotelline, and the third, nicotimine. These alkaloids occur in much smaller quantities than nicotine.

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Wasted Power.

A painstaking German scientist figures up that there is about 6,500 000 horse-power wasted in the blast furnaces of the world, which could be saved if the gases were used in gas engines. He also finds that 8,000,000 horse-power is lost in the undeveloped water-power sites in Europe alone. No doubt one of the advances that will be made in the present era of mechanical progress will be the utilization of such wasted or neglected sources of power. The trouble with water power usually is that it costs so much to install the plant that the interest on the investment makes the power more costly than power from coal would be. Moreover coal can be transported any distance, whereas water power must be used within a reasonable radius of its natural location.

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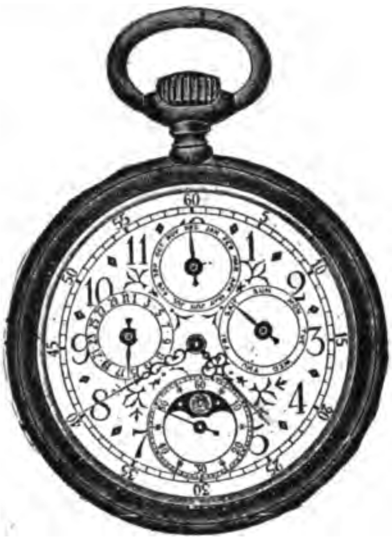

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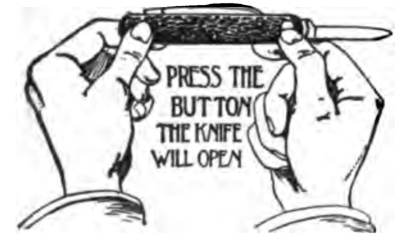
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The Dinosaur Beds of the Grand River Valley of Colorado. Field Columbian Museum. By Elmer S. Riggs, Ass't Curator, Dept. of Geology. Vol. I, No. 9. Being a report of the expedition sent to this locality in search of vertebrate fossils. The geological features of the section are well described, and the pamphlet includes five beautiful full-page half-tone plates, showing formation of sandstone, also maps, showing cross section of Grand River Valley.

The Fore Leg and Pectoral Girdle of Morosaurus. Field Columbian Museum, Elmer S. Riggs, Ass't Curator, Dept. of Geology. Vol I, No. 10. With three full plates, one showing complete right fore leg, and the others, various parts of same. Seven pages of text giving descriptions, etc., etc.

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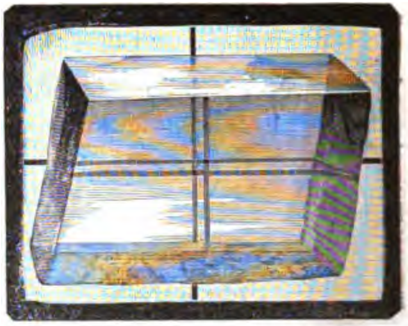

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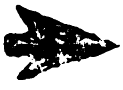

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THE WEASEL: THE REASON HE IS SO BLOODTHIRSTY

By SILAS A. LOTTRIDGE

THE Weasel is a carnivorous animal, closely related to the ferret, ermine, and martin. The body, which is cylindrical or even vermiform in in shape, measures about eight inches in entire length; the neck is rather long, the legs short; its range is North America, Europe and Asia In forty north latitude the pelage in summer is reddish brown with white below, while in winter it is white or a slightly yellowish white, except the tip of the tail which is very dark brown or black. This is the general change of coloring, being more marked at the north and less marked at the south. Sometimes white ones, such as shown in the illustration, are seen in this latitude, even in summer; both of these specimens were taken in July on the Orange Mountains, N. J.

The weasel is largely nocturnal in its habits, hunting and killing birds, rabbits, mice, rats, moles, squirrels, frogs, and poultry. Much has been written about this interesting little animal, and in natural histories such statements as the following are often found: "The weasel destroys for food alone, sucking the blood of its victims, and, if not hungry, it will hide the carcass until needed." But such statements are much too loose, the conclusions having been jumped at rather than reached after careful experiments or close observations.

My experiments with weasels extended over a period of several years. Some of those bearing on the statements just quoted I will give. Under an old barn I had a compartment which was made mouse tight, a ground space ten by fifteen feet. Connecting with this by means of small doors were two other compartments, also mouse tight, each of which was eight by ten feet. The larger compartment was fitted up as an ideal place for a weasel's home, with hollow logs, a stone pile, and and plenty of dry leaves and moss.

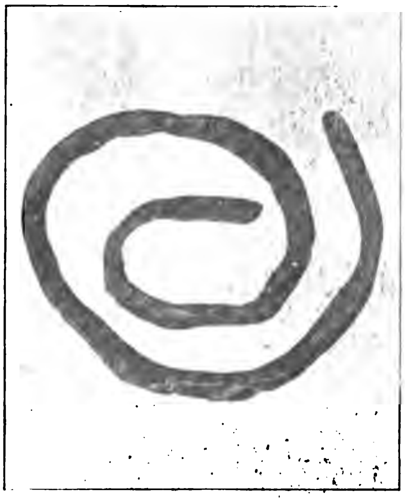
Experiments with four weasels, one at a time, proved that there was a wanton destruction of animal life; they killed as long as there was anything to kill. Just at nightfall there were placed in one of the smaller compartments an old rabbit and four young ones, and in the other compartment three chickens. At midnight the compartments were examined and not a rabbit or a chicken was found alive, and the remains had been left just where the victims had fallen. No attempt was made to hide the bodies for future use either at this time or at any other time during the experiments; at another time six chickens and six rabbits were killed in a single night.

In the first case all of the animals were killed by a single bite, except the old rabbit which was bitten twice in the neck. The brains of two young rabbits were eaten. In the second case the brain of one chicken was eaten, but neither in the first nor the second instance was any of the flesh tasted, and in the two experiments different weasels were used. The number of animals I put into the compartments never made any difference, one or a dozen, all were killed, except in one instance which I will cite later, but it made a marked difference in the number of brains consumed and the amount of flesh eaten. By regulating the food supply I found that the first choice was blood, next the brain, and then the flesh.

Why this is the order I will attempt to demonstrate. By accident I discoverd in the stomach of a weasel a large parasite. As this was noted again within six months, it occurred to me that perhaps this parasite was the cause of such an abnormal ferocity and love for blood. I accordingly set about definite investigation with the result that out of twelve weasels examined I found but two without the parasite. A part of this number I had experimented with in my weasel house before dissection, and the others had been trapped or shot. In every instance the weasels were caught in box traps and were free from injuries.

The third weasel which occupied the

weasel house was a fine male. On several occasions he left both chickens and rabbits in the compartments for two nights without killing them, and of ninety per cent. of the animals he killed in six months, portions of the bodies were eaten. Upon the dissection of this weasel no parasite was found. One of the weasels which was trapped and brought to me dead had no parasite, but its stomach contained much solid food.



PARASITE FOUND IN WEASEL'S BODY.
(Slightly reduced).

The only objection that could be raised to these experiments might be this, that a weasel, in its natural state, would act differently. In my investigations the natural conditions were followed as nearly as possible, and I will give two instances which proved to me that the weasels acted naturally. When a weasel finds the way into a chicken house he will return night after night until trapped or until the supply of chickens has given out.

During the past fall and winter, a farmer living on the Orange Mountain, had several of his chickens killed, and he knew by the remains that it must be the work of weasels. The chicken house was one in name only, and so the chickens roosted in several places. The fact of their being scattered prevented any great number from being killed at one time. When cold weather really came some of the chickens gave up the habit of roosting in trees, and gradually, from several sources, they gathered in the chicken house, until one night the high roosts were all taken and several had to take up with low perches. It so happened that the weasel came that night, and the next morning eight chickens were found dead.

This was too much for the farmer, so the old chicken house was repaired, and things went better for a week, and then two more chickens were found dead, but this time the exact entrance where the intruders came in was found—it was small, but an inch and a half is large enough for a weasel. A trap was set at once, and that night it was sprung, and a toe with a small sharp nail was found between the jaws in the morning. The trap was set again and nothing disturbed it for three nights, but on the morning of the fourth day it had a weasel; more than this, the weasel was one toe short on the left forward foot. Upon examination it was found that the weasel had recently lost the toe. Now, from this and from what we already know about the habits of the weasel, it is probable that this weasel was the one which had visited the chickens for some time past.

The flesh of none of the chickens had been eaten except in one instance; and upon examination of the stomach of this weasel, it was found to contain a very large parasite.

The other instance happened this spring; in another chicken house an animal found its way in and killed a chicken and parts of the flesh were eaten. From the remains it could not be determined that it was the work of a weasel, so the hole was stopped by means of a box, and if the animal escaped the trap it could not get at the chickens. The second morning the trap held a fine specimen of a male weasel; the stomach did not contain a parasite. In this case I have made no absolute proof that the weasel caught was the animal which ate parts of the chicken killed a few nights before, but I believe it to be the same.

This I have noticed with the weasels having parasites, that they were not in as fine a condition as those not having them. The fur in most cases showed a marked difference, being thicker and more glossy in those without the parasites. The length of the parasites varied from six inches to nine and a half inches, thus filling the stomach so full that there was little visible space for solid food. This seems to point to the conclusion that the parasite in the weasel's stomach is the direct cause for its choice of food and the blind ferocity that stamps the animal as a bloodthirsty little villain.

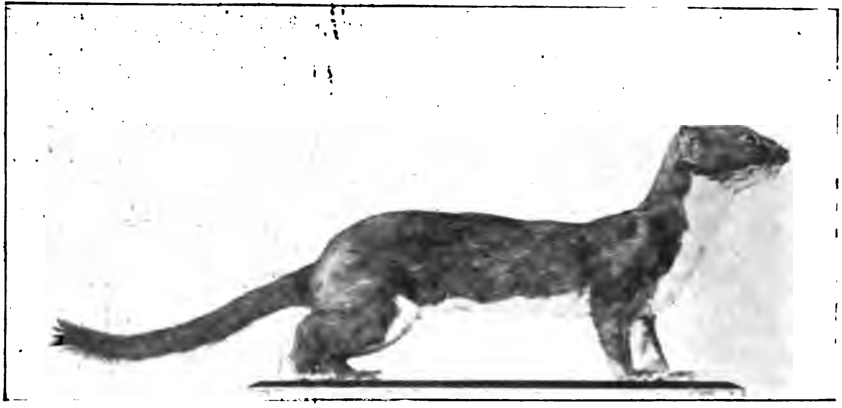


Photo by the author. THE WEASEL.

Space Telegraphy.

There are now in Europe 40 seaside stations equipped for wireless telegraphy and five in America. All of Lloyds' stations will soon have a plant.

Animal Life

WILD ANIMALS OF SONOMA CO., CAL.

BY MRS. IDA C. KELLY.

This part of the state, like others, shows the effect of increasing population upon the fauna of the locality. Each year some animals become more rare, until ere long they will be extinct. Within the recollection of our pioneers the grizzly bear, in the broad light of day, came into the dooryard of the settler in pursuit of a pig or calf: he is seen here now only in menageries. The black and cinnamon bear is still occasionally seen in the mountains around Cloverdale, the northern extremity of the county.

The American puma, or panther, as it is more commonly called, is the dread enemy of the remote sheep fold, though an animal rarely near dwellings. The Columbia black-tailed deer is still an inhabitant of the mountains and foothills. It is protected by law from July first to October first, and females are not legal game at any time. Venison can not be sent out of the county at all.

There is but one representative of the fox family, and that is the gray. It is not sly in the least, and when closely pursued will climb a tree. Some years ago a hunter came upon a fox asleep, and he soon killed it with a club, without disturbing more desirable game. Cherries are a favorite food with them, and a steel trap set under the tree will often catch two or three foxes in a season. The American wildcat, in limited numbers, still resides in thick woods; they seldom do much damage, probably on account of their scarcity.

In the coyote the wool grower finds an enemy worthy of his attention. So determined is the animal to feast upon mutton that the utmost watchfulness is necessary to prevent its doing so. They are generally caught in traps or by dogs trained especially for that work. The county pays five dollars for every scalp sent to the office of the county clerk, and the sheep men often give something in addition. Mountain goats are found in the northern part of the county, though they are not abundant. The flesh of the young ones is said to be excellent eating. The wild hog is another menace to sheep, causing sometimes heavy loss in a flock by disemboweling them with its strong tusks.

Our civet cat is a pretty little animal, about the size of the common house cat; in color they are brownish-yellow mixed with gray beneath; the tail, which is white, has from six to eight rings. They are easily tamed and great favorites of the miners. The California raccoon, very common here, is larger than its eastern relative. It has a fondness for poultry, and in some localities is so annoying that a coon hunt is considered great sport by young men and boys. Although coons may be killed in daylight by the aid of dogs, they are more commonly captured at night. If taken when young a coon is easily tamed and makes an interesting pet, though it must be restricted in its liberty. It is very amusing to watch one eat, as it dips each morsel in water before tasting it; and when its meal is finished, it carefully washes its face and hands. The common mink and the yellow-cheeked weasel are found along the water courses. The mink has a peculiar habit of dragging its toes when walking, thus making it easy to follow its tracks. Both of these animals are determined and persistent enemies of the hen yard; they do not eat the fowls, only taking the blood; a good steel trap is the best remedy for this evil.

The California skunk and the little striped skunk or polecat are plentiful. They, too, are fond of poultry, and do not hesitate to partake of eggs wherever they can find them. An egg, which has been poisoned with strychnine and put where others have been destroyed, is often successful in killing either animal. A California skunk is a difficult animal to shoot at night, as it carries its bushy tail erect and deceives one as to its body. The oil of the skunk is believed to have a medicinal value, especially for rheumatism. The yellow-haired porcupine is occasionally met with. And what a surprise awaits the brave dog that attacks it!

Of squirrels we have the California gray, chipmunk, Richardson's red, and the California ground. The first and last named do most damage; the gray squirrel has a very pronounced appetite for ripe strawberries and nuts, especially almonds. It is tamed without difficulty and makes a pleasing pet. The ground squirrel feeds upon roots and grains, and is very destructive. They are so active that it is a hard matter to shoot one before it goes into its hole. There are as yet comparatively few in this county. Both the gray and the ground squirrel are considered excellent eating. The gray squirrel is protected by law a part of the year.

The California gopher is a nuisance to farmers and gardeners. A dry winter is sure to be followed by an abundance of the pests; during a wet winter many are drowned. They almost ruin pastures and destroy young fruit trees by gnawing off the roots. In the garden few plants are sure of safety; dahlias, lilies and pinks are favorite food of gophers. Various means are tried to rid the locality of them; some persons plant castor beans, others caper plants, where there is most danger from gophers; others, again, rely upon coal oil poured into their holes. Probably the most efficient means of destroying them are by traps and poisoned raisins placed in their holes. The services of a good cat are not to be despised.

Of rats we have our share. Along the coast the wharf rat predominates, while inland we have the black, also the wood rat. All of these are very destructive; the black rat often feasts upon young chickens. The jumping rat is occasionally met with. There are long-tailed harvest mice and the California arvicole, or house mice in abundance here, but a few good traps soon cause their disappearance. Poisoned wheat is an excellent remedy.

Hunters and hounds have left a few California hares and rabbits. They have done very little damage here, and that chiefly to young orchards, by gnawing the bark of the trees. The flesh of both these animals is excellent.

The American beaver, though not numerous, exist in this county. They are known to live along the lagoons or lakes, and their peculiar habits make a study of them exceedingly interesting. Both the Oregon and the silver or prairie mole are found here. Their soft, beautiful skins are sometimes made into money purses, but the animals being so small, little use can be made of the fur.

In the Pacific ocean along our coast, we have two other interesting animals; the common seal and the sea lion. It is a pleasant pastime to watch them as they lie on the rocks or slip off so easily into the sea. Their peculiar bark can be heard for quite a long distance. Their skins are of little value, being very coarse, but the oil is used for various purposes.

Although Sonoma county is but a small portion of California, it is well supplied with native animals, and our people are awakening to the fact that if something is not done for their protection, many species will cease to exist. Each season the laws are made more strict and include more animals under protection.

Shoe Industry.

According to the census, there are 1,600 boot and shoe factories in this country, employing 143,000 men, using $170,000,000 worth of materials a year, and turning out products worth at wholesale $261,000,000. On the average the wholesale price of a pair of shoes represents about 22 per cent. in wages, 65 per cent. materials, and 13 per cent. minor expenses and profits.

American Mammoths

Of true elephants there appear to be three good species, Elephas primigenius, E. columbi and E. imperator. The first-named, the northern mammoth, a species of moderate size, having teeth with narrow enamel bands, seems to have ranged from Alaska southeasterly to about the latitude of Washington, D. C.

A line drawn from Washington to St. Louis and thence northwestward to Victoria, B. C., would roughly mark the southern boundary of its habitat. To the south of this line, extending to Florida and to the city of Mexico, is found Elephas columbi, a much larger animal on the average than the northern species, having teeth with coarser enamel bands. There seems to be an overlapping of the two species, especially in the northwestern United States, as noted by Prof. Cope, and along this line it is difficult at times, if not impossible, to tell from which of the two species individual teeth have come. Fully grown examples of this species must have attained a height of thirteen feet.

Elephas imperator was based by Leidy on an imperfect upper molar from the valley of the Niobrara distinguished by its great size and extreme coarseness of structure. This specimen long remained unique and was finally considered by Leidy to be the same as E. americanus or, more correctly, E. columbi, since the former name is unusable, being a synonym. Last fall, however, Mr. W. H. Holmes obtained in Indian Territory a considerable number of teeth of both Elephas and Mastodon from the same spot, comprising molars of M. americanus, E. columbi and some referable to Leidy's E. imperator. Teeth of this species may be distinguished from similar teeth of E. columbi by their coarse structure, the large amount of cement and the small number of enamel plates. Thus the upper molar of E. imperator has 17 cross ridges and one of E. columbi 21 or 22, while the number of ridges in the lower molars are respectively 18 and 22, this last being an estimate owing to the lack of a perfect specimen for comparison. In each case the molars of E. columbi are smaller. Thus Leidy's species may be considered as definitely established.—Science.

New Bears.

The national zoo at Washington is trying to get a specimen of the gray bear of Mt. St. Elias, Alaska, which was only discovered to the world a short time ago. This bear inhabits the glaciers and snow covered mountain slopes, and natural selection has made his color of such a blue-gray hue that at any distance he is invisible against the ice. A "spectacled" bear, brown over his body, and with white rings around his eyes, has also recently been found for the first time, on the high slopes of the Andes in Bolivia. The latter named animal should also be on exhibition at the zoo.

NATURE STUDIED BY ART.

BY H. W. PARKER.

A knowledge of nature is certainly helped much by the practice of drawing and painting. In microscopy it is essential; no study of objects under a lens is thorough and of lasting benefit without careful drawing of things examined; and coloring, too, is often of great advantage, just as it is in staining tissues the better to distinguish them. In larger nature, science deals with much that cannot be stated by pencil and brush; but the important study of form and color, scientifically, needs the accurate observation best insured by copying nature. In this, art is literal translation, while æsthetic art is free translation or suggestion only, with an emotional motive rather than the simple truth-seeking aim of science.

How much better observers of nature are those who have a habit of tracing outlines and modeling shapes, mentally, as well as discriminating tints of color. But this habit is not likely to be acquired except in the practice of art, as a diversion or self-education, not necessarily as a profession. There may be those who see and remember all natural details without this habit of mental picturing; most persons, however, are not of this sort, as might be proved by inability to give an accurate account of what they see,—about the rarest of abilities. Happily, the public schools are giving attention to drawing, and a race of better observers may grow up. Still, the instruction and practice must be very limited in the schools; and therefore some elementary suggestions here may be of value to many youths and adults who would improve their powers of observation.

No one should be advised to sit down and attempt to copy nature without some previous practice in copying good drawings in print. Of course, there is the danger of acquiring traditional and false conventional notions of art-work; also, lapsing into the soft misty style of aquatints and some lithographs, the blur of engravings from photographs, or the coarse effects of cheap illustrations. But there are published series of excellent studies of trees, for example, to be had of art-dealers, as well as series of animal forms. These, or some of them, are by acknowledged masters. To illustrate, there is the manner of giving the shaded parts of trees in leaf by close oblique lines; this makes easy the first blocking out of a tree's masses; and if the lines are in the direction of the sun's rays, as they should be, it is true to nature, which gives such lines of light sifted through leafage. There is, also, the style of leaf peculiar to the species of tree, indicated by running lines of curves or zigzags, or points, according to the characteristic effect, whereas an attempt to draw the separate leaves would be tedious and petty. The distinctive character of the tree is what is wanted, in every part, trunk, branches and leafage.

It may even be affirmed that copying good drawings is necessary to the beginner. There is no need to begin as Adam presumably did at the first round of the ladder, or as the prehistoric men did in the rude but wonderful pictures in caves. We can begin on the basis of previous masterly art. Besides, the beginner by copying can learn to see things as on one plane as artists do. The first useful lesson in perspective is to look from a fixed point—say the top of a stick on a pedestal—before a window, and with a bit of tallow draw the buildings, etc., seen through the glass as if they were pictures on the glass. The result is a new revelation to a person with uneducated eyes,—the relative size of things and convergence of parallel lines.

The drawing of single objects, such as plants and animals, impresses the details of form on the memory, though for mere recognition the so-termed *facies* of the species at once gives the distinguishing general features. Other drawings pertaining to science are geological maps and sections, and when original, are diagrams created from measurements of areas and strata. Yet, something of value can be sketched direct from scenes, as contours and the peculiar features of stratification and erosion, given in some geological reports, especially the outlines of mountain ranges and canyon walls, most happily rendered in mere line, after the style of two Indian villages in the March Popular Science News. When it comes to making the diagram of a crystal, one must be a mathematical mineralogist who has mastered this difficult subject.

With all the advantages of photographing directly from living forms, there may be the disadvantage in many instances of a neglect of that personal study of detail which is necessitated for good drawing. Photography in natural colors, however, measurably successful in the hands of experimenters, is still beyond the popular reach. Of coloring, in the study of nature, there is no room to speak in this article.

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The Asteroids.

During the year 1901 thirty-six asteroids were discovered, all but one of them at Heidelberg, by photography. The asteroid group is now known to have 475 members. No. 361 is interesting as having the greatest known aphelion distance, viz., 4.74 (the earth's distance from the sun being 1.00). The mean motion of No. 401 is approximately twice that of Jupiter. No. 475 is interesting from its great southern declination (61½°) at discovery, for its large eccentricity (e=0.38) and small perihelion distance (1.60). It was discovered at the Harvard College station at Arequipa in Peru.

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To Aid Digestion.

Crocodiles, like ostriches, swallow pebbles and small stones for the purpose of grinding their food.

TOPOGRAPHY OF UNITED STATES.

In its broader features, certainly, the classifications of the topographic divisions adopted by Mr. Gannett, the geographer of the census, are those which are generally accepted. The boundaries of the topographic division were adjusted to coincide with county lines in order that the statistics collected might be applied to each division. Of course, the extent of each topographic division, with this qualification, was determined by considerations of geology, topography, altitude, rainfall and temperature.

The marshy area extending along the coast from the eastern shore of Virginia to the Rio Grande is designated at the Coast Lowlands. The borders of these swamps along the Atlantic coast are being drained and converted into farms, a considerable area in the Carolinas being utilized for rice plantations. In the main, the coast lowlands are well timbered, principally with cypress and juniper.

Behind the coast lowlands stretches the coastal plain, a strip of land along the Atlantic and the Gulf between the lowlands and the Piedmont region. It stretches from New York Bay to the Mississippi, on both sides of which it extends northward to the Ohio River. It is cut into two parts by the Mississippi alluvial region. The coastal plain east of the Mississippi has good farming land, and having many industries it naturally has a far larger population in proportion to area than the coast lowlands.

Behind the coastal plain extends the Piedmont region from New York Bay southwest to the western boundary of Alabama. The limit between the Piedmont region and the coastal plain is fixed by the "fall line," where the streams passing from the hard granite rocks of the Piedmont region to the soft tertiary rocks of the coastal plain have rapids or falls marking the limit of navigation from the sea. Manufacturing towns from Trenton, N. J., to Montgomery, Ala., use the water power thus afforded.

The name Appalachian Valley is applied to a narrow region extending from the Hudson to northeastern Alabama, between the Piedmont region on the southeast and the Alleghany plateau on the northwest. Most of this mountain region forms a depression known as the Appalachian Valley. It is the source of a large part of our coal, and there are numerous iron industries, particularly in the northern part of it.

The region designated as the New England Hills is properly part of the Appalachian mountain system, but is here distinguished on account of its difference in character. The mountains, instead of being disposed in parallel ridges, are mainly isolated, irregular groups, such as the hills of Maine, the White Mountains and the Adirondacks. It is, on the whole, the largest industrial centre.

The Alleghany plateau, densely forested, is an escarpment extending more or less continuously from the Hudson River southwestward to Alabama, rising from the northwestern border of the Appalachian Valley. The plateau has been deeply scored into canyons by streams which makes it a very difficult region in which to build railroads. The result is that the central part of the plateau extending through eastern Kentucky and Tennessee is one of the least progressive parts of the country.

West of this plateau is a region comprising most of Ohio, Indiana, southern Illinois, west Kentucky and west central Tennessee designated here as interior timbered region, though a large part of it is included in some classifications as prairie. It has been the largest source of our hard wood lumber, and, when the white men first reached it, it was quite generally covered with forests.

The country bordering the Great Lakes is included under the name Lake Region. It is heavily forested, mainly by conifers, and is the largest source of white pine lumber. Its iron mines are also the most important in the country and many manufacturing towns are on the shores of the lakes.

The Prairie Region is a region of transition from the forested country on the east, to the barren plains on the west. As its rainfall is rather light most species of trees cannot thrive. It is the greatest region of cereal products and of the industries depending upon them.

The Mississippi Alluvial Region lies mainly below the high water mark of the rivers traversing it. The rivers by deposit have built low flat ridges along their courses, which, except in time of extraordinary floods, serve to confine them and protect the lower country. The only habitable parts are these river ridges, the lower country upon either side consisting of swamps. Thus the habitable part of this region forms but a small part of it. These river ridges are well cultivated in Louisiana, mainly in sugar, while higher up the rivers almost the sole crop is cotton which has an unusually long fibre, making it more valuable than the cotton of the uplands. The soil is extremely fertile.

The Ozark Hills in southern Missouri, Arkansas and Indian Territory are a very hilly region devoted to farming.

The Great Plains merge insensibly with the Prairie region. The line of demarkation has been set at the line of normal annual rainfall of twenty inches. These plains extend westward to the foot of the Rocky mountains and from the Canadian to the Mexican border. The rainfall is insufficient for agriculture, the water in the streams can irrigate only a small part of the land and the plains are now occupied mainly by cattle and sheep.

The Cordillera region is a plateau of which the Great Plains form the long eastern slope. The plateau extends to the Cascade range and the Sierra Nevada. On the slopes and summit of this plateau are vast numbers of mountain ranges and elevated valleys. The climate is arid, and irrigation as a rule is necessary for the production of crops. This region has been subdivided into several areas.

The Rocky Mountains include the most eastern of the mountain system in the Cordillera. It is composed of a series of ranges separatad by valleys trending parallel to one another and extends from the northern to the southern boundary of the country.

The Plateau region comprises most of the drainage basin of the Colorado River. It consists of great plateaus whose surfaces are level or slightly inclined and terminate in great lines of cliffs. Every stream is in a canyon, most of which are dry during the year. The higher plateaus having ample rainfall are green and forested; the lower plateaus are covered with sparse vegetation or are absolutely sterile.

The Great Basin in the interior of the Cordillera region is a large area with no drainage to the sea. The only outlet for its waters is by sinking into the thirsty soil or by evaporation. With the exception of the country along the lower Colorado and Gila rivers this is the most desert part of the United States.

The Columbian mesas, in the northwest, is an area drained by the Snake River and by that part of the Columbia above its passage through the Cascade Range. They are is in great part covered by eruptions of basalt which, bursting through the overlying rock, spread over the country forming many thousands of square miles of great table lands.

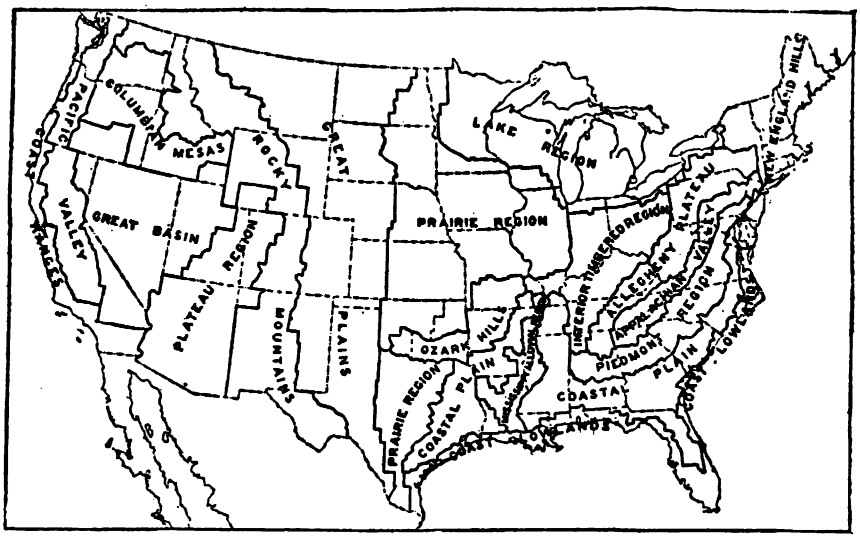
The Pacific Valley lying parallel to the Pacific Coast, a short distance inland, is a great depression extending from British Columbia southward into southern California. The regions along some of the rivers and other bodies of water in this depression, as Puget Sound, the Willamette river of Oregon and the Sacramento and San Joaquin of California, are among the most fertile regions of the Pacific slope.

The Coast Ranges separate this valley from the Pacific. In Oregon, Washington and northern California they are heavily timbered. The valleys among these ranges, especially in southern California are very fertile and produce a great variety of fruits, many of which are tropical in character.

These facts show that the Great Plains is the most extensive topographic division, followed closely by the Prairie region, the two together including nearly one-third of continental United States.

The eastern boundary of the Great Plains about bisects the country, 49 per cent. of the area of the United States lying west of that north and south line, and 51 per cent. lying east of it.

It is also shown that the Prairie region and the New England hills include over three-tenths or 31 per cent. of the population of the country, while the Lake region and the interior Timber region include over one-half of the population.—Sun.



TOPOGRAPHICAL MAP OF THE UNITED STATES.

Ancient Business Methods.

A document of the year 54 A. D., recently unearthed in Egypt, reports an English journal, proves that the ancients were more particular as to the form of a receipt than the most exacting business man of to-day. The translation is as follows: Ammonius, son of Ammonius, to Tryphon, son of Dionysis, Greeting I agree that I sold to you the weaver's loom belonging to me, measuring three weavers' cubits less two palms, and containing two rollers and two beams; and I acknowledge the receipt from you through the Bank of Sarapion, son of Lochus, near the serapeum of Oxyrhnchus, son of Lochus, of the price of it agreed between us, namely, 20 silver drachme of the Imperial and Ptolemaic coinage; and that I will guarantee to you the sale with every guarantee, under penalty of payment to you of the price which I have received from you, increased by half its amount and by damages this note of hand is valid.

The wording is similar to some legal documents of to day.

THE ZODIACAL LIGHT.

BY ARTHUR K. BARTLETT.

At this season of the year, on every clear evening during the absence of the moon, there is visible in the western heavens after sunset, a strange illumination known as the zodiacal light, which very much resembles the faint glimmer of the aurora borealis, and might easily be mistaken for that interesting phenomenon of the northern sky, by those unacquainted with astronomy, were it not for the position it maintains, and the singular form it invariably presents to the observer. This remarkable celestial spectacle, which has doubtless been noticed by every person who enjoys an occasional survey of the heavens at this season, has attracted the attention of astronomers from time immemorial, but has never been satisfactorily explained, and still remains an enigma in astronomical science, though many ingenious theories have been advanced to account for it, none of which are yet accepted with confidence as a solution of the mysterious apparition.

The form of the zodiacal light is that of a cone or pyramid, having a rounded top, with its base directed toward the sun, and its axis nearly in the plane of the ecliptic. Its light is like that of the Milky Way, or that of the faint twilight, thin enough to let the stars be seen through it, and seems to surround the sun in the form of a lens, the plane of which is nearly coincident with that of the sun's equator. The apparent angular distance of its vertex from the sun varies from forty to ninety degrees, and the breadth of its base, perpendicular to its axis, from eight to thirty degrees. It is believed to extend beyond the orbit of the planet Mercury, and even as far as that of Venus, but—with occasional exceptions—never so far as the orbit of the earth.

This wonderful illumination is not mentioned by any of the early writers on astronomy, though it certainly could not have escaped the notice of the Arabian and Grecian astronomers. An ancient Aztec manuscript preserved in the Bibliotheque du Roi, at Paris, is said to contain an account of a mysterious light that was visible for forty consecutive nights in the year 1509, and which Montezuma regarded as an omen of his downfall. This is now believed to have been an unusually luminous zodiacal light, as it is recorded to have been seen in the immediate vicinity of the sun when it was below the horizon. The phenomenon was first noticed in Europe by Prof. Childrey, in the year 1661, but it was afterward more particularly observed and described by the celebrated astronomer, Dominic Cassini, in the spring of 1663. Humboldt observed the various intensities of this wonderful light in the tropical regions; and he saw it flicker and wane from a very strong to a pale light, and then suddenly shoot up again as bright as before. A peculiar gleam similar to the zodiacal light, if not identical with it, is described by John Christopher Sturmius, a German philosopher, who flourished during the last half of the seventeenth century. He called it Heliocometes, or comet of the sun, because the light, which he sometimes observed at sunset, appeared like a large column of light attached to the sun, like the "tail" to a comet.

The Rev. George Jones, of the United States Navy, a member of the corps belonging to the Japan expedition, made numerous observations on the zodiacal light, showing that, in that climate, "it never fails to be seen when the moon and clouds do not interfere." Biot thought that the zodiacal light might be in some way connected with the earth, and by repeated experiments he found that it gave more heat than the tail of a comet. When at the summer solstice, according to the observations of the Rev. Mr. Jones, the zodiacal light was visible from 11 P.M. until 1 A.M. in both the eastern and western horizon, with their apexes approaching each other. From the facts which he accumulated in regard to this singular exhibition, Mr. Jones concluded that the light was a nebulous ring surrounding the earth, in which the meteors and shooting stars may have their origin. Prof. Pierce concurred with Mr. Jones in his theory, and Prof. Gould thought that Mr. Jones' observations threw more light on the nature of this strange illumination than all other astronomers before him. But this theory has long since been exploded, and is now regarded as absurd in the light of more recent researches; for, whatever its nature and constitution may be, the zodiacal light is known to be a solar appendage, and in no way connected with the earth or its atmosphere.

The zodiacal light is so called from the fact that its axis is inclined to the horizon in the direction of the zodiac, the broad belt or zone within which the sun and major planets perform their revolutions over the firmament. The season most favorable for observing this celestial glimmer is when its direction is most nearly at right angles with the horizon, and it is least obscured by the twilight. In northern latitudes this occurs in February and March for the evening, and in October and November for the morning, when it is visible in the east just before dawn. At places favorably situated, even in the temperate zone, it may be seen at almost every season, and on or near the equator it increases in intensity and height, and it can be observed throughout the year. In our climate, the light is rather more intense than that of the Milky Way, and also much more uniform. It is brightest in the parts nearest the sun, and in its upper part its light fades away by insensible degrees, until it becomes too feeble for distinct vision, so that different observers, at the same time and place, assign to it different limits, according to their respective powers of vision; but the distance to which the light extends from the sun varies with the season of the year, and the condition of the atmosphere. Peculiar undulations and flashings resembling the aurora have been noticed in it when the sky was unusually clear and the moon absent.

The light really extends out on each side of the sun, and lies nearly in the plane of the ecliptic; and the direction of the axis of the cone of light, if prolonged below the horizon, always passes through the sun. Prof. Newcomb says: "It lies very nearly in the plane of the ecliptic, but its exact position is difficult to determine, not only owing to its indistinct outline, but because in northern latitudes the southern edge will be dimmed by the greater thickness of atmosphere through which it is seen, and thus the light will look farther north than it really is. The nature of the substance from which this light emanates is entirely unknown."

In our latitude the zodiacal light can be seen distinctly only after the evening twilight during the months of February and March, and before the beginning of the morning twilight in October and November; for at these times it stands most erect above the horizon, and is therefore farthest removed from the thick vapors and twilight. It is also faintly visible during the month of April, in the evening, and about the time of the winter solstice it may be seen in the morning, but it is seldom perceived in summer, on account of the long twilights at that season. It is more easily and more frequently observed in tropical countries, and particularly near the equator, than in our own country, because in those regions the obliquity of the equator and zodiac to the horizon is less, and the duration of twilight is much shorter.

Arago's "Popular Astronomy" contains the following passage regarding this singular phenomenon: "Prof. Mairan asserts that this species of light had already been seen by the ancients. Nicephorus, says the author of the treatise on the 'Aurora Borealis,' relates that after the capture of Rome by Alaric, a great eclipse occurred during which there was seen in the heavens a light which had the form of a cone. The Greek historian treats as ignorant those persons who pretended that this light was the tail of a comet." Arago adds to this that it is remarkable no trace of the zodiacal light, at least with its aspect of an "iron lance," has been seen by modern astronomers during total eclipses of the sun, and finds an explanation in the circumstance that the light is seen only in the twilight, when stars of the third and fourth magnitude are easily perceived by the naked eye, whereas, the corona of the total eclipse throws light enough into the atmosphere to render invisible, in its neighborhood, the stars of that magnitude. Yet, many eminent astronomers think that the zodiacal light ought to be looked for in every total eclipse of the sun, and the atmospheric condition might sometimes be such as to render it visible. If ever seen during a total eclipse, it would probably appear as faint and conical lights, extending in two diametrically opposite directions, with their bases toward the sun.

The late Prof. Steele, in his excellent work on astronomy, thus refers to the interesting spectacle: "If we watch the western horizon in March or April, just after sunset, we will sometimes see the short twilight of that season illuminated by a faint, tremulous light, of a conical shape, flashing upward, often as high as the Pleiades. In September and October, at early dawn, the same appearance can be detected near the eastern horizon. The light can be seen in this latitude only on the most favorable evenings, when the sky is clear and the moon absent. Even then, it will be frequently confounded with the Milky Way or auroral lights. At the base it is of a reddish hue, where it is so bright as frequently to efface the smaller stars. In tropical regions the zodiacal light is perpetual, and shines with a brilliancy sufficient, says Humboldt, to cast a sensible glow on the opposite part of the heavens."

In the equatorial regions, at high elevations, the zodiacal light has been seen at all hours of the night to extend entirely across the heavens, from the eastern to the western horizon, in the form of a pale, luminous arch, having a breadth of thirty degrees, and there is said to be in it, at a point exactly opposite to the sun, a patch a few degrees in diameter and slightly brighter, called the gegenschein or zodiacal counterglow. This faint light is seen by the naked eye only in the zodiac and always about 180 degrees from the sun, and the phenomenon is as great a mystery as the zodiacal light itself. A recent explanation is that it is due, like the luminous redness of the eclipsed moon, to the refraction by the earth's atmosphere of sunlight, which is made to converge in the shadow of the earth and reflected—in the one case by the moon and in the other by the meteor dust of space, or by clusters or shoals of small interplanetary bodies, too minute and faint to be seen individually.

This strange patch of light, which is one of the most interesting of astronomical puzzles, may be best seen in September and October, and affords an excellent test of one's powers of vision. The late Prof. Proctor, in his "Essays on Astronomy," presents an interesting paper to which we refer the reader for a learned and exhaustive discussion of the subject. He begins his remarks by saying: "It cannot but be regarded as a remarkable circumstance, that the nature of the zodiacal light should, in the present state of astronomy, continue to be a quaestio vexata." Prof. Chambers' "Handbook of Astronomy," Vol. I, also contains an excellent description of the spectacle, with the various theories and observations pertaining to it.

As the illumination always accompanies the sun, it is evident that it can not be a terrestrial appendage. The fact that its aspect and position are the same in different latitudes, and its axis is situated in the same part of the heavens, from whatever locality the light is observed, indicates that it is too far away from the earth to have an appreciable displacement from the effects of parallax. It is the opinion of most astronomers that the phenomenon is caused by a faint, cloud-like ring, perhaps a meteoric zone, that surrounds the sun, and only becomes visible to us when the sun is below the horizon. The theory now generally accepted attributes the illumination to sunlight reflected by an immense number of meteoric bodies—very small and perhaps thrown off by comets—revolving around the sun nearly in the plane of the ecliptic, most of them being within the earth's orbit, forming a thin, flat sheet like one of Saturn's rings, extending beyond the orbit of the earth.

These meteors are like those which the earth is constantly encountering in space, and which, on entering our atmosphere, become visible to us as "shooting stars." In the zodiacal light they are too small to be seen separately, even with a large telescope, but they combine in unknown millions, according to this theory, to reflect to our eyes the peculiar light in question, borrowing it from the sun, around which they all revolve, probably in elliptical orbits like the planets. All of these meteors together would, by their reflection, produce the pale, diffused light, which we observe in the west at this season of the year. This meteoric zone, if it extends beyond the earth's orbit, must have a diameter of at least 200,000,000 miles. Prof. Young says: "While this theory, however, is at present more generally accepted than any other, it cannot be said to be established. Some are disposed to consider the zodiacal light as a mere extension of the sun's corona, whatever that may be." It is a singular fact to be regretted that, as Prof. Chambers well remarks, "Little or no progress has been made during recent years in elucidating the theory of the zodiacal light; and this is the more remarkable considering the development of all other branches of astronomy."

Recent observations with the spectroscope, that marvelous instrument of science, have shown that the zodiacal light gives a continuous spectrum, which indicates that it is composed of solid masses, and shines by reflecting to us the sun's light. The subject is certainly worthy of attention, and future observations may not only throw light on this particular phenomenon, but present to our contemplation a singular variety of celestial bodies with which we were formerly unacquainted. If our sun could be viewed from one of the other stars, it would doubtless appear to be surrounded by a nebulous light, similar to that in which some of the "fixed" stars appear to be enveloped, as seen from the earth.

Naval Architecture and Marine Engineering.

One of the features of the new engineering building at the University of Michigan will be the installation of an experimental tank for instruction and research purposes in connection with the courses of naval architecture and marine engineering. The tank will be 300 feet long, 22 feet broad, and 10 feet deep. The principal investigations for which it is designed will be of two kinds; first, those connected with the models of various types of vessels, and secondly, those relating to propellers.

The method of conducting experiments upon ship models is, without entering into detail, somewhat as follows: A model from ten to twelve feet in length is made accurately to the desired form from the drawings. This is accomplished by means of a specially designed cutting machine. When finished it is ballasted to the required trim and displacement, and is then in a similar condition to that required in the full-sized ship.

In order to determine the resistance to forward motion, and hence the power at any given speed, the model is towed by means of a dynamometer attached to a truck which extends across the tank and runs upon rails on either side, the truck being driven by a motor. If for example, a spring dynamometer is used, the extension of the spring determines the force required to move the model at the given speed. By suitable arrangements the speed of the travelling truck may be altered to any desired extent and the resistance of the model at any speed determined. Thus a complete record of any given form of vessel from the lowest to the highest speeds may be obtained. In a similar manner the effects of alteration of form upon the resistance may be investigated.

In order to pass from the model to the full-sized ship, recourse is had to certain well-known laws, into which it is unnecessary to enter here. Suffice it to say that the resistance of a full-sized vessel may be dermined with absolute accuracy from the results of experiments upon her model.

Investigations upon model propellers are conducted in a similar manner, the observations taken being those of thrust, turning force, revolutions, and speed of advance. The laws connecting these quantities for the model with those of the full-sized propeller are somewhat similiar to those of the model ship.

By performing the two foregoing experiments together, the case of the ship being driven by her own propeller may be produced exactly upon the model scale. Numerous other experiments may also be performed.

Plant Life

THE TRILLIUMS.

BY BESSIE L. PUTNAM.

Among the largest of our spring flowers, these fair blossoms, like their near relative, the lily, are showy without being gaudy. Just why the trillium should have been classed by earlier botanists as a nightshade seems, in the light of modern accepted relations, quite an incongruity; yet it points to only one of the mazes into which pioneers were drawn in their labor of systematizing plant relationships. As a result, the popular name three-leaved nightshade still clings to at least one member of the genus, vying with wake robin, beth-flower, birthwort, wood lily, lamb's quarters, Indian balm and Indian shamrock for recognition.

Dr. Gray classed the trillium with the lilies, but Wood and some other botanists placed them and Indian cucumber in a separate group, a distinguishing feature being the whorled leaves and a conspicuous tendency to net-veining; though in both leaf and petal the base of the branching veinlets is in prominent parallel veins. Britton, in his Illustrated Flora, makes a still different classification, placing the trillium in the Lily-of-the-Valley family by virtue of its fleshy, berry-like fruit, quite in contrast to the loculicidal capsule of the lily.

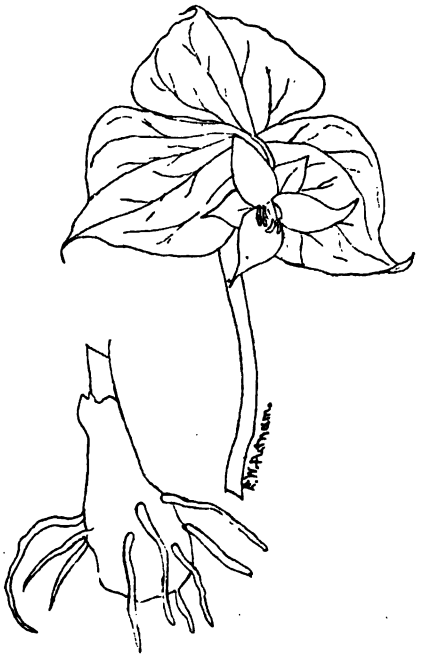
Despite these little technicalities, children will continue to gather the "wood-lilies" under that dearest and to them most appropriate of all names. And in comparison with the true lily, the structure of the latter is more fully revealed. The flower is normally in each case made up of threes, the outer row or sepals of our subject being green, while those of the lily partake of the delicate color and texture of the petals.

Though type specimens are strictly on the plan of three, leaves, sepals, petals, stamens (6), and styles, few plants show a wider range of variation; and in this feature there is an abundance of material for the botanist, the novel forms often illustrating a valuable principle in morphology.

Michigan is especially rich in these vagaries, and a wet season is evidently condusive to their development. T. grandiflorum, a magnificent species with large snowy white petals changing to rose color with age, is the most prolific of abnormal forms. Specimens with some or all of the parts in fours or even fives are frequently met; or the leaves may be reduced to two. From both Michigan and Buffalo, N. Y., come reports of individuals with double flowers, eighteen petals being counted on a single flower at both stations.

Willard N. Clute records in Meehans' Monthly an instance in which the three normal petals had a curious companion in a fourth member of their own texture and color, but differing in shape, and having a pollen-bearing anther attached to its side. Prof. Meehan speaks of the value of such monstrosities in the study of plant morphology, this one clearly showing the few elementary parts of which a plant is composed, and the similar origin of both petal and stamen.

The trillium often carries this still further; and that flowers are but modified branches and their parts modified leaves is shown by the frequent tendency to reversion of the petals to green. Before me is a fine specimen of T. grandiflorum from Central Michigan, the large snowy petals of which are most artistically margined with a broad band of green. The variations in the genus have led in past times to many sub divisions and varieties in nomenclature; modern research, however, tends to guard against a multiplication of varieties, and to regard the unusual forms recurring with more or less constancy as simply "freaks," useful in determining the evolution of plant life.


THE TRILLIUM (T. ERECTUM).

T. erectum is one of the most widely distributed of the species, occurring, according to Dr. Britton, "In woods, Nova Scotia to James Bay and Manitoba, south to North Carolina, Tennessee and Missouri. Ascends to 3,000 feet in Virginia. Also in Japan." This last habitat recalls a peculiarity frequently noted: Plants common to our eastern slopes but not found west of the Rockies are indigenous to Japan. How they got there is a query yet unanswered.

The slightly drooping flower of T. erectum (shown in drawing), seems to brand the specific name a misnomer. But when we recall the fact that only two others of the species, T. sessile and T. cernuum, the former with sessile flower and the latter with peduncle always strongly recurved, were then known, the claim of this species, which at least starts with erect flower stem, seems not so illy founded. It is easily recognized by the dull madder-red petals, dark ovary and malodor. A form with cream colored or nearly white petals is not infrequent.

While none of the trilliums are fragrant, this one has a peculiarly offensive odor. Clarence Moores Weed, in his fascinating book, "Ten New England Blossoms and their Insect Visitors," calls attention to the fact that the plant is cross-fertilized by flesh flies, doubtless attracted by the double bait, both color and odor of the blossom mimicking that of decaying flesh. And just here it may be well to note that dull red or purple color and carrion-like odor are frequent companions. The skunk cabbage is a familiar illustration. One of the exotic arums has a dark purple flower with a most pronounced carrion odor on the day it opens. This odor passes away in a day or two, probably after the necessity for insect visitors has ceased, and flower lovers may then admire its strange attire without offense to the olfactories.

Though a few species of Trilliums are found in Japan and the Himalayas, it is essentially a North American plant, seven distinct species being now recognized east of the Rockies, while as many more are found in the extreme south and west. Like many of our native plants, it has been partially or wholly eliminated from many former haunts. This is partly due to the destruction of forests, partly to indiscriminate plucking. There is a common tendency to pluck the wild flower, even it be thrown away after being duly admired. Children gather the blossoms in great handfuls. And on Decoration Day the trilliums furnish a goodly share of the woodland display. All this, despite the fact that with the blossom come stem and leaves,—all the organs that work above ground are destroyed. Can we expect but that under such conditions the race must in time become extinct? Nature calls for atmospheric work some weeks after this, and the subterranean organ, deprived of its legitimate assistants, can only in part perform the allotted functions. It is readily transplanted to the garden, where it blooms freely, increasing slowly in the number of flower stems from year to year.

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Flower Decoys.

One of our native orchids, Listrea ovata, has a flower which in shape resembles a species of beetle. So writes the Rev. Alex. Wilson in Knowledge for April, and he proceeds: Perhaps in this case the insect mimics the flower, as certainly happens with a pink-colored Mantis in Java, which so exactly resembles a pink orchid that butterflies are attracted to it in mistake. The insect is carnivorous, and lies in wait for its prey, which is easily secured by the help of this strange disguise. Mutual resemblances of this description are rather characteristic of the Orchidaceæ.

From their resemblance, real or fanciful, to butterflies, moths, bees, spiders, etc., various species of Habenaria, Neotinea, and Ophrys derive their names—the butterfly, spider, bee and fly orchises. In the orchid Ophrys muscifera are two little protuberances regarded by the late H. Müller as pseudonectaries. Of this class of deceptive contrivances, however, we have a better example in Parnassia palustris, one of the saxifrages This flower has five fan-like scales alternating with the stamens; the margins of the scales are fringed with hair-like processes, and each hair is capped with what appears to be a drop of honey. These are really hard dry knobs, but so much do they resemble daops of honey that flies lick them before discovering the imposture. The intention of these sham nectar-drops may either be to decoy unprofitable guests from the real nectar, of which a limited supply is produced in the hollow of each scale, or to advertise it for the benefit of the more intelligent visitors.

Somewhat analogous to these pseudonectaries are the greenish swellings which arise on the veins of the petals of Eremurus. These little swellings present a striking resemblance to aphides or plant-lice, and Kerner states that a fly accustomed to hunt after aphides pierces and sucks the swellings, apparently mistaking them for the insects.

Growing Water Lilies from Seed.

The process of growing water lilies from seed is not very tedious and may be done as successfully in the humblest home as in the finest conservatory. I submit a few notes for the benefit of those who desire to try growing them from seed, but who do not have access to a greenhouse.

Hardy Nymphæas.—An important item in this connection is fresh seed. The best time to sow them is in the fall, soon after maturing. Self sown seed nearly all germinate. When this has been omitted they can be sown out of doors in either natural or artificial ponds, in March or early April. Select a sunny, sheltered place where the water is six or eight inches deep, with good soil bottom. Plant each seed by pressing it into the soil and covering it one-quarter inch deep. Protect from fish and water fowls. I prefer to sow in boxes of soil sunk in the water. Then in case of a rise or fall of the water the boxes can be dragged in or out, keeping the young lilies at a congenial depth until they become strong enough to battle against drouth and flood. If one has no ponds, seed may be sown in tubs filled half full of soil and to the brim with water. With the warm days of spring and early summer most of the seed will germinate and the plants may remain in the seed beds until the following spring.

Nelumbiums may be planted in exactly the same way as hardy Nymphæas. The seed should first have a hole filed through the hard shell to allow the water to penetrate to the kernel, else they may lie in the water indefinitely without germinating.

Tender Nymphæas.—In the absence of a greenhouse probably the best way to sow these is in a tub of water in a bay window or other light window near to a heater. With the majority of us, probably the kitchen window with a southern exposure and close to the range is most convenient. The time for sowing these is now at hand, in order to have early bloom. Fill some 5 inch pots with garden soil, sprinkle the seeds on, press down firmly and cover one-eighth inch. Sand is preferred for covering, as it holds the soil in place and prevents the seeds from floating. Two or three pots will be sufficient for a packet of seed. Set the pots in tub and pour in water until the pots are covered four or five inches. Keep the water at a temperature of 70°—a little higher in the daytime would be better—and some of the varities will be up within two weeks. Others will linger for a month. When the first leaves begin to float transplant them, giving each plant a two-inch pot. In course of a month they will need another shift and may call for more tub room before removing to the ponds out of doors in June. Persons not having space enough to admit a tub can sow the seeds in pails, bowls, pans or any convenient and clean vessel that will hold water, preserving the same idea as given above.

Seeds of tender water lilies may also be sown out of doors after the manner recommended for hardy ones, except they should not be planted until danger of frost is over and the water becomes warm. This throws the blooming period so late in the fall, however, it is but little practiced, except to grow the tubers to keep over winter for another season.

Victoria Regia and V. Randi require a temperature of 90°, and an attempt to grow them without a greenhouse generally ends in failure. V. Trickeri (Cruziana) will germinate under the same conditions as the tender Nymphæas.

Varieties —A word on this might not be out of place just here. All seed cannot be relied on as producing absolutely the same variety as its parent. All varieties of water lilies do not mature seed; some seeds are slow to germinate. For these reasons the practice of reproducing water lilies from seed is not in general favor. A sufficient degree of success may be gained, however, to liberally reward one's efforts. The varieties that do best from seed are: Tender—Victoria Regia and its varieties; N. Zanzibarensis and its varieties; N. dentata, N. O'Marana, N. Lotus, N, gracilis, N. scutifolia, N. cœrulea; Hardy—N. odorata and most of its varieties; N. tuberosa and its varieties; the Nelumbiums.—Amer. Gardening.

Dwarf Trees.

Dwarf oak trees are cultivated by the Chinese. They average from six inches to a foot in height, and are perfect in every respect.

Trade Relations with Great Britain.

In 1895 our exports to Great Britain amounted to $387,000,000 and our imports from that source were $159,000,000. In 1901 our exports rose to the enormous amount of $631,000,000, while our imports were only $143,000,000. Such a change as this is almost revolutionary in its results, as it leaves a trade balance in our favor of $488,000,000, which must be paid in some way.

England is the great common carrier of the world, and doubtless the freight that was paid to her for transporting the great amount of merchandise represented by the above figures, materially decreased this balance. An additional factor of no mean proportions, is the amount spent by American tourists in England; however, there was still a balance of something over $250,000,000, that must have been paid by the return of American securities to this country. In other words, the Englishmen must have squared the international account by allowing us to repay about $250,000,000 of the money we have borrowed from them in the past.

Such a tremendous balance on our side of the account cannot continue for many years, for eventually all our obligations to the English capitalists will be refunded, and then there will be no other way to balance accounts except for us to take English securities in exchange for our merchandise. In fact, a small beginning in this direction has already been made; last year a portion of one of the English war loans was floated in New York, and we became for the first time the creditor nation.

All this is very gratifying to American pride, but such a state of affairs is not likely to long continue, as it is largely due to the fact that the Englishmen are not doing their best. In the first place, their conservatism makes them loath to adopt new machinery and modern methods; then the trade unions have attained such power that they dictate just how much shall constitute a day's work. These trade unions seem to be unable to comprehend the true relations that should exist between capital and labor, and have adopted a policy that is bound to result in disaster. They argue that there is but so much work; therefore they will do but little each day, in order that it may last longer. Of course, the natural result of this policy has been to increase the cost of production, and this has enabled us to undersell them in their own market.

However, some fine day they are going to wake up to the fact that they have got to give up the go-slow policy and do their best in order to compete with the goods we are offering them; when this time comes, as it is bound to come, it will greatly reduce the annual balance due us, and will upon the whole produce a more healthy condition of trade.

It behooves us in this country to profit by England's trade union experience.

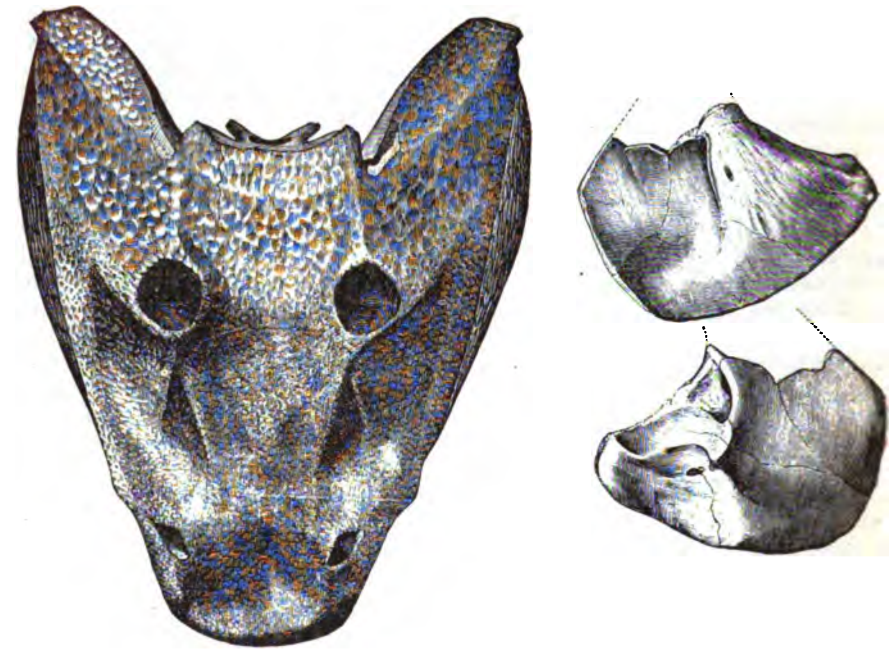
Archaeology

THE PERMIAN OF TEXAS.

BY CHAS. H. STERNBERG.

I conducted an expedition into the valley of the Big Wichita, for the Paleontological Museum, of Munich, Bavaria. I began work on the 14th of June, 1901, and continued four months,—was employed by the famous Dr. von Zittel, the early teacher of the lamented Cope, and other American paleontologists. It was pleasant to receive these words of praise from such a noble source, "Your collections from Kansas and Texas in the Munich Museum, will always be, as I wrote you, an everlasting memorial to the name of the collector." I labored, assisted by by my son George, this season under trying conditions, the heat often running the mercury up to 113 degrees in the shade, and when reflected from the brilliantly colored rocks, it was very severe on the eyes. The whole Wichita Valley was almost a desert, the few cattle scattered over thousands of acres were poorer than I have seen them in mid-winter in former years. There are no springs or wells in the Red-Beds. Spasmodic showers are partly retained in natural or artificial tanks. I had to haul my camp water from six to eighteen miles, as well as hay and grain for my team.

By constant effort under the difficulties that beset me, I was able to add over twenty forms of the early vertebrate life to the Munich Museum—most of which are new there. No work, I believe, has been done on these remote ancestors of living animals since Cope died, except in Munich; Dr. F. Broili received the degree of Ph. D. from the study of the Eryops material I sent their museum in 1895. His interesting memoir on Cope's great salamander, Eryops megacephalus, was published in 1899. As Dr. von Zittel's assistant he came from Bavaria to visit my camp, and spent two weeks with me in the field, taking notes and photographs of the formation; he was delighted with the results of my work, assuring me that the collection I had made was of far greater scientific value than the one I made Dr. Zittel in 1895. I believe a number of new species are present, as well as many described by Prof. Cope; one, his Diplocaulus magnicornis, here figured from his original drawing of the type, was quite common in certain localities. I found in the roots of the grass, and along a slide, ten casts of skulls I thought worth saving, with fragments of many others scattered around, every particle of bone having disappeared. I, however, got several better specimens than the type, including the limbs, and column attached to the head. I suppose this unique amphibian was an ancient frog. The skull is very much compressed vertically, the mandibles are usually locked with the maxillæ; at the premaxillæ the jaws are only about half an inch thick, while the horns measure an inch and a half in thickness. I found several skulls that measured over a foot from the end of the chin to the distal point of the horns. The whole skull appears as a comical imitation of the Man in the Moon when it is half full. The very beautiful sculpturing on all the outer bones is remarkable. The vertebræ have twin spines on each side of the centra. I think when alive the frog must have been six feet long.



ERYOPS MEGACEPHALUS. FIG. 2 —⅛ NATURAL SIZE.

Another species I discovered of the same genus, had a skull much narrower behind without horns, and not so much compressed vertically. One head was so beautifully preserved, and cleaned under long erosion, it was difficult to believe it was not a recent specimen. As a rule, all the fossils in this formation are covered with thin red siliceous matrix difficult to remove; when exposed to the weather for a long time this is sometimes worn off. This region was the home of Cope's great salamander, Eryops megacephalus, which ought to mean flat-headed.

Fig. 2 represents this wonderful amphibian's skull, here represented from Cope's original drawing of the type. When we compare our living American salamander, that rarely reaches a length of over 8 inches, with this grandfather of all the mud-puppies, we are struck with the enormous proportions reached by Eryops during the Permian.

I found an absolutely perfect head this year that measured about 20 inches in length, and in which the bones that support the tongue, are present; it is covered with a thin siliceous matrix. All the outer bones of the skull are beautifully sculptured. The bones that support the broad, flat quadrate, are projected well back of the brain-case; the lower jaws extend still further back and are more powerful than those of an ox, a single row of large and small teeth occupy the jaws, while the palatines carry 6 sets of two powerful conical-shaped teeth placed closely together, three sets on each side of the roof of the mouth. The skull is vertically compressed, but unlike Diplocaulus, the eyes are well back; the occipital condyles are shallow saucer-like pits. The creature was about 10 feet long.

I found a nearly complete skeleton of this huge animal for Prof. Cope in 1896, under peculiar circumstances. It lay at right angles to the old Chisem Trail, over which thousands of Texas cattle had made their weary pilgrimage to Kansas and the North; the constant wear of countless feet had worn off the flint-like matrix, and exposed the completely petrified bones, while on the ridges they were not exposed at all, except in cross-section caused by breaks.

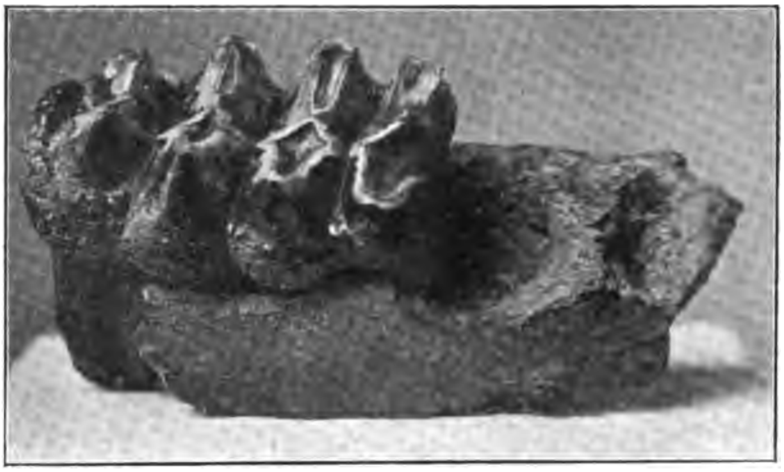
The vertebræ are of a lowly type; the centrum is composed of three distinct bones—the central or plurocentrum, and the two latteral pieces or hypocentra; the dorsal spine, with its processes attached are in one piece. That same year of '96, I was so fortunate as to find a batrachian with a carapace,—one of those rare discoveries of a life time that connects great orders. Prof. Cope believed this to be the parent stem from which sprang the great family of turtles. At a later period in the history of my life, my son George and myself, discovered three bone-beds full of minute forms, several of which are I believe new to science. I look forward with great interest to their description by the Munich Museum. They range in size from less than one-fourth of an inch to an inch in length. I got over twenty perfect skulls, many with vertebræ attached, and thousands of small bones from all parts of the skeleton. In one case a complete skull, one-fourth of an inch in length, had connected with it nearly the entire vertebral column, with ribs in position, coiled upon itself, bedded with many bones of other species in a red siliceous matrix. So perfectly were they weathered out that they lay in bas-relief as white and perfect as if they had died a month ago; a single row of teeth like the points of cambric needles occupied both sets of jaws. It seems to me this little fellow, not over six inches long, must have lain down in a snug bed of mud to hybernate, and never awakened.

Millions of years later, I found it ready to do its share by adding one more fact to human knowledge, one more link to the endless chain of life Nature has produced so abundantly on this old world of ours. I dare not even guess at the family to which it belongs. The bones of the skull are perfectly preserved, quite smooth, and show the sutures distinctly; there is no distortion, some red matrix attached below seems absolutely necessary to convince the mind that it is not a thing of yesterday. Others were broad and flat, a little like Diplocaulus, eyes well forward, an inch long, with delicate tracery upon the bones, and single rows of minute teeth. Some were compressed latterly, the delicate little quadrates connecting the mandibles with the skull at an angle of forty-five degrees. In this form the orbits were placed far back in the face. In another extremely beautiful skull the bones were marked by small dentations and elevations, very much compressed vertically, and had small teeth in the front part of the jaws only.

I should not neglect in this connection the enormous Dimetredon of Cope, a reptile of large proportions and huge dorsal spines. Some of these spines were over three feet long, with a pair of lateral spines at the base, after that they alternate to the apex; these lateral spines are smooth and conical, slightly recurved, with round indented knobs at the distal ends; the first pair are about three inches long, and they gradually decrease in size.

I call this animal the "Ladder-Spined Reptile." I am told Prof. Cope believed these spines served as masts and yard-arms from which were stretched membranous sails, which enabled them to catch the breeze and tack along the surface of the ocean. Possibly as the main spine is extremely slender, shaped below like an inverted V, to each limb of which were round articulations to fit into corresponding pits in the center of the vertebræ, which were themselves quite small, these lateral processes gave stability, and when held by strong muscles securely bedded in the flesh prevented dislocation. I have found many fine specimens of this remarkable reptile; one found this year represented parts of the upper and lower jaws. A massive bone projects beyond and below the huge tusks in the lower jaws, bent in a curve and presents a unique appearance, for what purpose I can hardly guess unless to give rest to the head when sleeping. But time would fail me to tell even in this cursory manner of all the strange life of these ancient mariners who lived in the water or along the marshy shores of the old Permian ocean. How those ancient frogs must have tortured the ear of night on a warm evening! But I must turn for a short time to the rocks.

There are two formations in the Permian of Texas as distinct from each other as if separated by thousands of miles, so different is the character of the regions they occupy. I visited one point on Poney Creek, in Baylor County, where the Red-Beds lay conformably upon the Grey ones. Looking to the west, a vast panorama of crumbling and denuded bluffs, ridges, narrow valleys and other characteristic Bad-Land scenery, desolate and forlorn, with the dull red color dominating everything, except where here and there it was relieved by stunted patches of mesquite or other vegetation, while to the east lay the narrow and shallow valley of Poney Creek, with typography so familiar to residents of eastern Kansas. A ledge of grey sandstone five feet thick, following the trend of the low hills and around the ravines, grass coming down in gentle swells to meet it, or running up from the valley below; here were ponds of living water. I was camped in the valley in September. No rain of consequence had fallen since May, when on the 3rd, it fell in great quantities and lay everywhere on the surface of the ground, but soon disappeared, and I crossed the dry creek bed to work at a locality rich in invertebrates, discovered by my son, who soon shouted that if I did not want to swim I better recross. I did so in such haste that I left my tools behind, and a raging, howling torrent of water instantly covered the rocks over which I had crossed dry-shod. Going into the hills east of camp, I made a discovery that solved the question that had perplexed me for years, viz.: why there are no springs, wells or running streams in the Red-Beds, except just after a shower.



MASTODON TOOTH FOUND IN CANADA.

I found where erosion had cut a section through the Gray-Beds, while a long, level floor of its upper layer covered with the debris of the Red-Beds extended back to a ledge of red sandstone eight feet thick; although these beds were dry on the surface, a miniature watefall fell from under the debris, over the sandstone ledge into the ravine below, proving to my satisfaction, that the pervious nature of the 300 feet of red-rocks allowed the water falling upon it to percolate through to the compact grey sandstone below, and run off at whatever angle they chanced to be tilted. The first layer is very compact sandstone, so finely pulverized that it is almost as fine as flour; but on exposure it breaks into angular blocks so regular in shape it can be built into walls without the use of hammer or chisel. The second, twenty inches thick, of same general composition, breaks into blocks of many tons weight, and contains a few casts of invertebrates. The third stratum, 12 inches thick, though of the same grey color and general character, is literally packed with the casts of coiled and straight Nautili-like shells; some I judge are a foot in diameter. The last layer is eighteen inches thick, very dense and heavy, its surface crossed at all angles by elevated rounded ridges.

A Mastodon Tooth.

Herewith is shown a reproduction from photograph of a mastodon tooth, found four feet deep in the bottom of a creek located seven miles distant from Chatham, Ont. Mr. L. C. Burt, of that place, who found the specimen, sent in the photograph and particulars.

The tooth, with portion of jaw bone attached, weighs seven pounds, and is 11⅞ inches in length. The tooth itself has a high polish and is a very fine specimen.

Aid for Achæologists.

The Académie des Inscriptions et Belles-Lettres, says the Paris correspondent in The Times, has voted 30,000f. to Father Delattre in order to enable him to continue his excavations on the site of Carthage.

Minerals

[Edited by A. C. BATES].

Quartz.—Theoretically it should be true that any crystallizing compounds whose parts are of invariable proportions, and acting under the same conditions, should produce constant forms, and in large measure it is true. Concerning ourselves now only with quartz crystals, SiO_2, we find that certain localities produce certain constant forms, varying only in size and in mild modifications. Thus the well-known crystals of Herkimer Co., N. Y., are so constant in form that an examination of nearly one hundred thousand crystals revealed but one wide variation—a crystal showing a minus half P. See Fig. 1. About five per cent. of the lot showed the plane S. Distortions are common. Inclusions of lignite and crystals with cavities containing water and a movable bubble are quite common. Crystals off color are rare. Crystals vary in length from 3 inches long down to microscopic size. Yet with all these "variations" the statement that the forms are constant is substantially true.

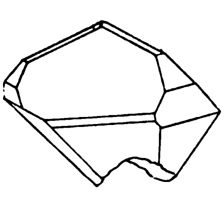


FIG. 1.

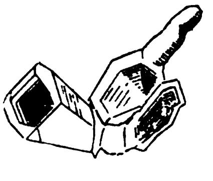


FIG. 2.

Near Pinal, Arizona, occurs a peculiar form of quartz commonly called hollow crystals, which radiate from a centre of chalcedony and are always associated with it. In many instances the hollows seem to be formed by a grouping of several crystals expanding from a common root centre, as do the petals of some flowers, while in others the hollows seem to be contained in a single crystal, which is seldom more than an inch long. The top of the widest hollow is about one-half inch across and tapers to base of crystal. See Fig. 2. These Arizona hollow crystals are a very interesting study in crystallography, and some of their features indicate the influence of the associate chalcedony on their formation. The composition of quartz and chalcedony are given as identical; the first is crystallized and the latter cryptocrystalline, and to this difference in structure in some measure is doubtless due the form of these crystals.

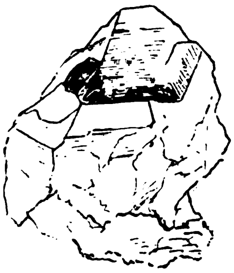


FIG. 3.

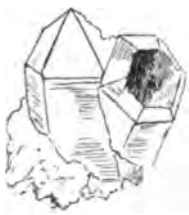


FIG. 4.

In 1895 there was discovered in Lincoln Co., N. C., a pocket of loose single and small groups of quartz crystals of an amethystine tint associated with a green muscovite. Nearly all of these crystals had hollow pyramids, and were called "cup" crystals. Excepting the hollow pyramids they differed in all other features from the Arizona crystals. They are stouter and the planes of the pyramids inside and outside of the hollows are much better developed. The strange feature to be considered is that of inconstancy of form. Fig. 3 shows a single hollow crystal. Fig 4 shows a grouping of two crystals only one of which is hollow. A partial cause of the hollow form may be found in the small crystals of muscovite held in the quartz at base of each cup crystal.

The muscovite doubtless influenced the direction of the crystallizing force. There was no foreign matter in the hollows themselves. The influences at work with the crystallizing forces in the silica of North Carolina are such as to produce a greater diversity of forms of quartz crystals than has been exhibited at any other locality. Yet these diversities of forms have such distinctive features in themselves as to make the constancy of form no exception to the rule relative to a locality. The crystals of Alexander Co. differ materially from those of Lincoln Co., and any one of a dozen pockets of quartz crystals found in Lincoln Co. may differ from the others, and be so distinctive as to be easily recognized and located by one familiar with the product of each.

The hollow crystals are not of the sunken planes variety; they are hollow in most specimens to nearly their full depth. We shall continue the subject of quartz crystals.

Ideal Specimens in matrix form are rare, but are quite common in loose crystals. A matrix on which are placed nicely isolated, well formed crystals as distinguished from groups or bunches of crystals may be considered ideal. A matrix having but one good-sized, well-placed crystal is in some minerals the most desirable specimen one could wish for; but such are extremely rare in other than imbedded crystals. Some imbedded crystals such as garnet, pyrite, staurolite, etc., may be worked out into relief, and if the matrix be of good quality the specimen is considered a pleasing one. The obtaining of ideal specimens is, however, more a matter of opportunity than of satisfying individual taste. Still it is well to educate one's tastes up to the ideal point even though many things may prohibit one's often satisfying them.

Hydrolites are geodes of chalcedony which contain water, and are found at Astoria, Oregon, Tampa Bay, Florida, and in Uraguay. The largest and best shaped ones come from Uraguay, and so long as they continue to hold the water are considered valuable. Of two fine specimens purchased in 1900, one of them a year later had lost all its water, leaving no trace behind how it was lost. The water holds some silica in solution, and if the geode had been accidentally cracked the injured part would have been closed up by the last of the escaping water. When the shape of these geodes lends itself to the purpose, they are sometimes made into viniagrettes by jewelers, who saw off the tops and mount the parts in gold. One such piece was recently held by a New York firm of jewelers at $250.

Department of Mines. A bill to establish a department of mines and mining, with a cabinet officer at its head, has again been introduced into Congress. Considering the vast capital invested in mining and the general economic conditions respecting minerals, such a department should tend to extend and systematize their development and uses.

Diamond Cutting. The new cutting called the "Twentieth Century" cutting has just been introduced. This new cutting does away with the flat table of the brilliant and increases the number of facets from 58 to 80. It is so scientifically accurate in form that diamonds cut in this style scintillate equally from every point of view, and are intensified in beauty to an extent hertofore unknown.

Itacolumyte or flexible sandstone occurs at several places in the Southern States, the most notable of which is Linville Mountain, Burke Co., N. C. This mineral is made into specimens by sawing or cutting it into strips up to two feet long, by from one to six inches wide, the thickness depending on the splitting of the stone when quarried.

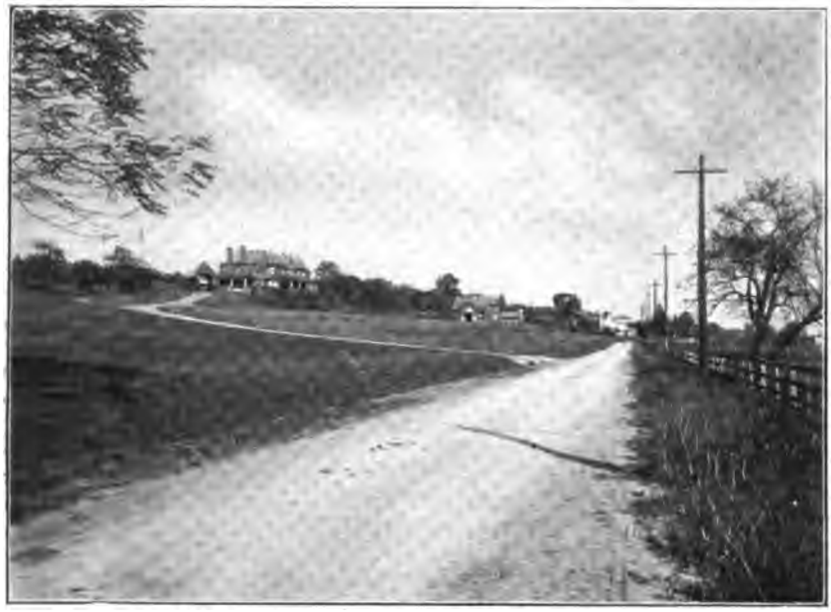
The peculiarity of the stone is that, while it looks just like an ordinary piece of sandstone, it is capable of being bent in the hand with considerable less force than is required to bend a piece of wet leather of equal thickness. When examined with a lens, by reflected light, the particles of which it is built up are seen to be movable individually by using a needle point. When a thin slice of the stone is looked at under a lens, by transmitted light, the fragments are seen to be locked together, like the parts of a section puzzle toy, fixed, but not loosely. Of course, there is no means of flipping out the various sections of the stone, as the interlocking is not only in one plane, but in every direction. The simplest way of explaining how this stone was formed is to say that the grains of sand were once cemented firmly toby another material, which has been partly dissolved, leaving countless natural ball and-socket joints of jagged shape behind. Good specimens may now be had of dealers at from 25c. to $2.00.

Photography

TELE-PHOTO WORK.

BY D. P. D.

There is a peculiar charm about the photographs taken with the form of lens known as the tele-photo As the term implies it is the adaptation of the telescope to photographic work. Just as the object appears close to the observer when viewed through a telescope, so does the object or view when taken with the tele-photo attachment.

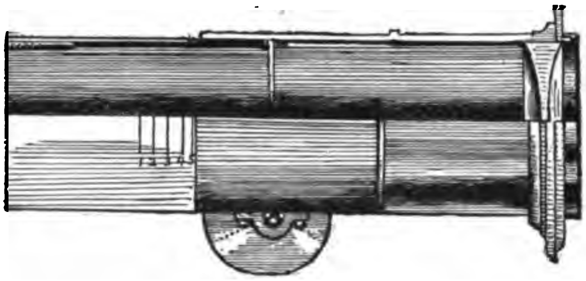


Harvey Conklin, Photo. FIG. 1.—TAKEN WITH RECTILINEAR LENS.

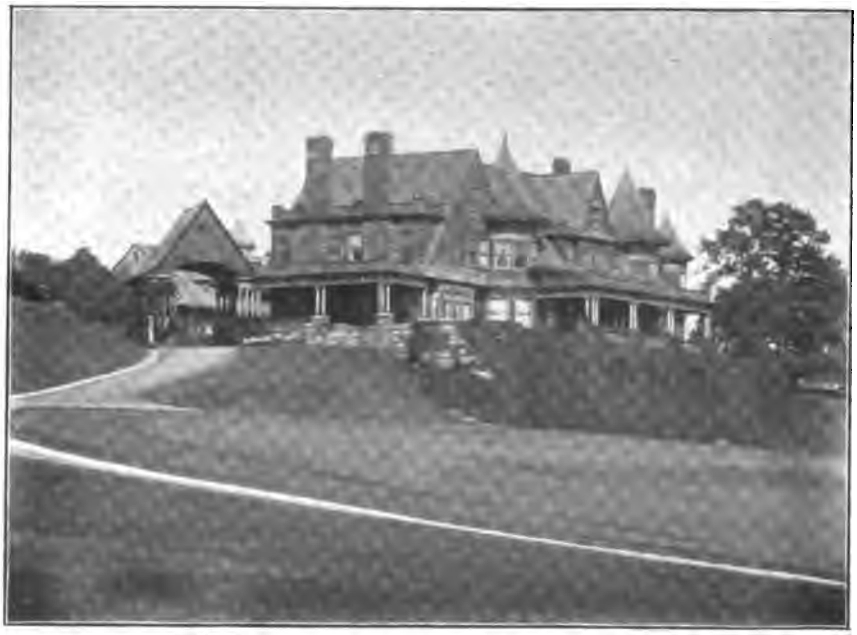
It is very often impossible to place the camera equipped with the ordinary landscape lens close enough to a much desired object, and in such cases the tele-photo is useful. Under some circumstances high towers, and very often buildings and grounds, make a much more satisfactory photograph when the tele-photo is used. The broad expanse of foreground is entirely lacking, and the result seems more natural for the reason that the perspective is better, appearing just as it does to the eye because it embraces a smaller field. It will sometimes greatly improve architectural pictures, giving a mass of detail, especially in the case of very tall buildings; also for ornamentations that are often in towers, or for large-sized statuary that cannot be produced by other means.

For long distance work it is necessary to have a camera with a bellows capable of great extension, and absolute rigidity is required. Sometimes a trembling that would ordinarily not be noticed, will spoil the plate by blurring, and often the operator places the blame on the lens because he neglects this point; on occasions the use of two tripods is advisable. The weather conditions also must be considered, for it is impossible to secure a sharp image if the atmosphere is not perfectly clear, and the light is not ample. A point to be remembered by those who contemplate using the tele-photo attachment, is that a high quality lens is essential, for any imperfection, even if so slight as to be negligible at ordinary times, becomes greatly magnified through its use.

The photographs here reproduced are of a northern New Jersey residence, and well illustrate the difference between the rectilinear lens alone, and the same lens with the tele-photo attachment. They were both taken from precisely the same spot within a few minutes of each other, the tripod never having been moved. With the rectilinear lens, (Fig. 1), the exposure was ⅛ second with stop 128. In the case of the tele-photo (Fig. 2), the exposure required was 10 seconds with 32 stop; fast plates in both cases.



HIGH POWER TELE-PHOTO LENS.



Harvey Conklin. FIG. 2.—SAME VIEW, WITH TELE-PHOTO ATTACHMENT.

A striking feature of the examples here shown is the fact that they were both taken at a distance of considerably more than an eighth of a mile, and Fig. 2 is so perfect in detail that it seems to have been not more than fifty or seventy-five feet distant from the camera.

Photographic Notes.

Photography is now holding a higher position as a fine art than ever before, but its position is by no means fully established. But it is far enough advanced so that it is beginning to be divided into two classes, artistic, and commercial. With the latter, the price per dozen prevails Artistic photography can never have a price per dozen; the care and effort involved to produce a certain effect are at the most too great.

To restore a changed platinum print, a mixture of hydrochloric acid and chlorine water is recommended, conveniently made by adding a few drops of sodium hypochlorite solution to dilute hydrochloric acid (1 of acid to 10 or more of water may be used) until the odor of chlorine is distinctly noticeable.

Various Topics

THE ORIGIN OF PETROLEUM.

BY ALGERNON GRANVILLE.

The great and increasing activity which has been manifested in the oil industry throughout the United States during the past few years, and which seems to give promise of even still greater attention to this attractive and lucrative business in the immediate future, makes highly interesting at this time the discussion of that unsolved problem: "What is the origin of petroleum?" Old as is the use of oil obtained from the earth,—the written history of its discovery in Egypt alone dates back to the time of the early Pharaohs,—no attempt seems to have been made to enquire into the genesis of this most useful substance until about the middle of the last century.

In 1847, an English chemist named Young, succeeded in obtaining oil through the distillation of coal, which in the process involved was subjected to a very slow heat, and satisfactory results from the commercial point of view of that time were procured in this manner. Subsequent to these efforts, shale oil, a product of bituminous shale, submitted to the same process of distillation, was extensively manufactured in Scotland and Wales, and from these results and similar efforts elsewhere, it was finally determined that petroleum was the product of the distillation of coal by the heat of the earth in past geologic ages. There until the present time the matter has rested as a subject which might be considered as settled for all time to come, and were it not for the striking fact that in the great Texas oil field, recently discovered, and in the Louisiana, Florida, and some of the western fields also, there is a complete absence of any coal or any proximity to it, no further hypothesis than that already given might be deemed necessary to explain the origin of this useful fluid.

The prevailing notion that petroleum is a comparatively modern discovery, has probably done more than anything else to militate against our inquiry into its origin, beyond what has already been found out. If we look back into ancient history, however, we shall find that this useful product was well known under various names and in various countries, and it is curious to note in passing that in some parts of Asia, as well as Europe, where it is found, there are no traces of coal to be discovered, whatever.

In Burmah, for instance (one of the oldest countries from which rock-oil has been obtained), there is an absence of coal in those regions where it is discovered, and the Island of Zante, where Herodotus describes the famous oil-springs, is totally wanting in the coal measures. On the shores of the Caspian Sea, and in some of the contiguous islands, where volcanoes finish their eruptions with a burst of petroleum, no coal has so far been found, and the Sicilian oil alluded to by Pliny as being burned in the lamps of his day, simply oozed to the surface of the earth from shallow depths, alike wanting in coal or any allied substance. In many of the oil regions of Siberia we find no traces of coal, and in our own country, where oil is produced abundantly, as in Texas, Florida, Louisiana, Colorado, and portions of Montana and Wyoming, as well as in parts of West Virginia, Ohio and Pennsylvania, the coal measures abruptly break off, or are totally wanting altogether.

These being the facts with relation to crude petroleum all over the world (though of course it is found in vast quantities where coal exists), it becomes necessary to modify our ideas with respect to its origin, and to see if we cannot discover some better hypothesis, which will equally account for this valuable product being found associated with coal, as well as in places where that substances is totally absent.

The theory of the chemical origin of petroleum through the distillation of coal in the bowels of the earth in remote geologic ages, has involved a series of very interesting experiments in the laboratories of several well known chemical authorities. In these experiments, some powerful deoxidizing agent, such as iron at a white heat, has been made to react with steam and carbonic acid, depriving both the hydrogen of the steam or water and the carbon of the carbonic acid of their original oxygen, and resulting in the formation of a greasy liquid almost identical with petroleum.

It has also been found that shale, peat and wood, as well as even the famous "burning rock" of the Northwest, when subjected to distillation, have produced a similar result, and have all been made to yield up their quota of petroleum in quantities more or less abundant. But this is not all. It has also been found that when animal matter has been submitted to the same process of destructive distillation to which the mineral and vegetable substances were subjected, there was obtained an oily liquid, consisting of the same compounds of hydrogen and carbon as are discoverable by analysis in the petroleums of Pennsylvania, Ohio and West Virginia.

Is it not possible then that right here we have a solution to the problem, and that the oil which gushes forth in localities where no trace of coal can be found, is but the accumulated remains of those vast hordes of invertebrates, or fishes, or even of those gigantic reptiles and other animals which during the various eras of our earth swarmed over the land or occupied the seas in untold myriads, and found their last resting place, when death supervened, upon the steaming earth and torrid sands of the primeval tropics, or upon the beds of ancient oceans, in the early morning of the world's existence? Does not this hypothesis better fit the varied conditions of the earth under which we find oil to-day, associated here with the coal deposits,—themselves the product of decayed vegetation,—and again appearing where no such substance is found, than that other hypothesis which insists upon its carboniferous origin, and neglects to explain its sudden discovery in regions which are totally lacking in the coal measures?

In different countries throughout the world, every stratum of the earth shows oil in quantities more or less abundant, the earlier strata, when organic life was most prolific, though of a low order apparently producing the largest supply.

Passing by the earlier stages of the Palæozoic Age, however, which through the invertebrates in the Silurian, and the fishes in the Devonian Eras, were probably responsible for the oil-bearing strata found to-day at great depths, we come to a more interesting period of the world's history,—the Carboniferous Era. It is now more than twenty-five millions of years ago, according to the latest geological opinions, since our earth, warmed by the rays of a fiery sun, was luxuriating in the most abundant vegetation which has ever blessed this planet, and which was so profuse at that period of the world's history that if compared with the densest of African jungles to-day, it might appear as some mighty monarch of the forest by the side of some delicate garden flower. To the death and decay of all this wonderful vegetation, continued through hundreds of thousands of years, we owe the coal deposits which underlie our soil.

This was the Carboniferous Era, extending through uncounted years, but it was also the forerunner of the Age of Reptiles. Over the land at that time in myriads poured vast hordes of saurians, of many varieties and many types, whose last descendants to-day in the persons of the alligator and the crocodile inhabit the swamps of Florida, or bask upon the banks of the Ganges or the Nile,—perhaps in some of those very tropical spots where their ancestors, huge in size and dreadful to behold, romped and roamed at their pleasure in their search for food. Curious amphibians, characteristic of the age in which they lived,—some large, some small, some snake-like and some lizard-like with feet,—moved around amid the marshes or on the land in countless numbers, and strange inhabitants of primeval oceans and continental seas contended with each other in their daily struggle for existence.

The Permian period, which marks the transition from the Palæozoic to the Mesozoic Era, completes the monstrous work commenced by Nature in the Carboniferous Era, introducing to our notice on the scene of its greatest activity the wonderful Age of Reptiles. At this period, the energy of the earth was at its height, and never in its history were reptiles so abundant, of such varied sizes and shapes, so numerous or so gigantic. In the Triassic and Jurassic divisions of this Era, the chief characteristic of this age is the culmination of these hideous monsters, direct descendants of those earlier forms of life, which had their origin in the Laurentian rocks, and which through the fierce struggle of succeeding ages, had slowly battled their way to the front to become at length the mighty monarchs of a world.

So true is this, that during the Jurassic period they may be said to have dominated the world,—on earth, in water and in sky,—for the dinosaurs on land, the ichthyosauri on sea and the pterosaurs in the air, each represented a stage of organic existence, the hugest and the most monstrous which the world has ever known. In that age there was no higher type than these strange creatures, whose skeletons to-day lie scattered through our western plains. From the winged reptile, such as the pterodactyl, the birds were yet to develop in due time; the marsupials and the mammals were still to be evolved, and Man, the successor of a long line of animals of lesser mental capacity, including the lemurs and the anthropoid apes,—man, the finality, the crown and glory of all, was yet to be.

But gone forever are these mighty inhabitants of an age which has passed away! Vanished the Dinosaur; the spiny Stegosaur, and his kindred; the Iguanodon, and all the weird, strange and monstrous varieties of their reptile race. Silent their fossil remains adorn the shelves of our museums, or under the skillful hands of the scientist,—their forms restored to their original shapes,—these curious creatures of a by-gone age look mildly down upon us from the glass cases of a natural history room. For back into the arms of old Mother Earth each one in due time fell, and the beginning of a new stratum in the formation of the shale which lies imposed upon the sandstone, marks the resting place of those saurian monarchs which once ruled the earth, and sets a fitting seal upon the mightiest mausoleum of the world's most vigorous period of activity.

Such is the story of the closing stages of the Mesozoic Era, and such in the demise of its inhabitants the wondrous contribution which they made to the sandstones of the earth, from which we now extract our western and our southern oil. To the marine saurians of the Jurassic period, Texas is indebted for the great gushers which come from Spindle Top. Wyoming, Montana and Idaho owe their oil to the land or marsh reptiles of the same age. With California it is a little different, for her supply of petroleum is drawn from the Tertiary deposits, laid down at a time when the mammals ruled the earth, and birds with gay plumage were singing in the trees. But whether in Texas or California; in Siberia or Japan; in West Virginia or Ohio, the origin of oil everywhere is just the same. Look where we will or search where we may, it comes to us from that great stream of animal life which rose unreckoned ages since, and now, in strict obedience to the laws of evolution, is moving forward to that exalted goal to which the genius of the human understanding can fix no limit. If we procure it from the coal regions, or distill it from the peat, the shale or even the rock which underlies our earth, these substances have nevertheless at one time been intimately associated with the organic creatures of the past, and impregnated with the oleaginous material of which their bodies have been composed, in order to account for its presence in their constituent elements to-day.

The icy fields of a frozen North frown down upon us in the Klondike in our search for gold, while the lurid rays of a tropical sun beset our steps in Africa or Brazil, when in pursuit of the diamond or other precious stone, but it may probably be said with truth that of all the treasures which man has sought for beneath the surface of the earth, petroleum places in his way the least of obstacles, and with its varied uses and its great and permanent value to the human race, it is perhaps the most wonderful, the most beneficient and the most important of all he has discovered.

Tests for Blood Stains.

In 1898 and 1899 M. Bordet showed that by injecting the defibrinated blood of any animal into the blood of animals of different species the serum of the latter acquired, after a time, the property of agglutinating and of dissolving the corpuscles of the blood of the former. Moreover, he showed that the serum mixed with the defibrinated blood of any other species formed, after a few minutes, a clear, limpid, red liquid, while if it were mixed with the blood of the animal from which the blood had first been injected, it formed an opaque liquid from which a flocculent mass was quickly precipitated.

His experiments, which gave a test for blood stains, have been repeated and extended. Mr. Uhlenhuth has applied it to blood from oxen and rabbits. Every week he injected 10 cubic centimetres of defibrinated ox blood into rabbits and after five such injections he obtained a serum that dissolved all blood except that from oxen. Analogous experiments with human blood gave like results. It was possible to discriminate between drops of human and of ox blood that had been left to dry for a month on a wooden plank.

Messrs. Wassermann and Schutze have carried such processes further and have experimented on the blood of twenty-three species of animals, and confirmed the former conclusions. The serums were a perfect test. It is noteworthy that the blood of monkeys and of men were somewhat similar in action. Spots of blood three months old could be discriminated. The importance of this discovery is great.

SOME RECENT WORK ON HYDROGEN DIOXIDE.

BY FREDERICK H. GETMAN.[1]

Since 1818, when Thenard announced his discovery of hydrogen dioxide, the number of chemical compounds known to man has increased enormously and yet no one substance has proven of greater interest than this.

One only needs to follow the history of the substance from the time of its discovery to the present day to learn that our present knowledge of it has cost a vast amount of labor, and to find that it has been the cause of the most bitter of scientific polemics.

In 1895, when Brühl stated his belief that the oxygen in the compound was tetravalent, he was regarded by many chemists as a teacher of "false doctrine," and yet to-day we are accepting his view, not only with respect to the oxygen in hydrogen dioxide, but also in many other compounds. Some years before the work of Brühl, Hanriot announced that hydrogen dioxide exhibits acid properties. This statement has been refuted repeatedly, and to-day if we find it mentioned in a text-book of chemistry we are certain to find a statement from the author to the effect that it is very doubful if not untrue.

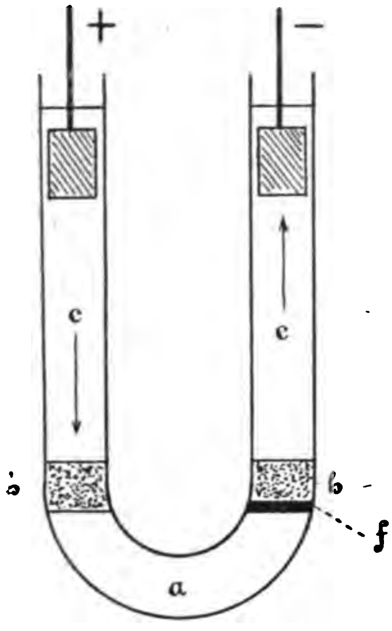
While many of the problems presented by hydrogen dioxide remain unsolved, the question which has been raised as to its acid character has been answered with assurance within the past few months. The experiments of Bredig and Calvert have shown most conclusively that *hydrogen dioxide is an acid.*

Bredig was led to perform these experiments from an observation which he had made previously in a study of the catalytic action of platinum on hydrogen dioxide. He found that the catalysis was retarded by acids, while alkalies tend to accelerate the action. From this he was inclined to think that the alkali might form a salt with the hydrogen dioxide, and to confirm his views, he, together with Calvert, carried out a series of experiments. They employed five different methods, all of which lead to the conclusion that hydrogen dioxide is an acid.

The first method is based upon the principle that a substance will divide itself between two solvents in such a way, that the ratio of the concentration in each remains constant provided the solute has the same molecular aggregation in each.

They used water and amyl alcohol as solvents and found the "partition coefficient" to be a constant 7.03. When, however, sodium hydroxide was added to the water, the partition coëfficient underwent a decided change. As the results of many measurements with varying amounts of sodium hydroxide, they found that the ratio between the quantity of hydrogen dioxide combined and the quantity of sodium hydroxide with which it was in combination was such as to plainly indicate a salt consisting of one molecule of sodium hydroxide and one and a half molecules of hydrogen dioxide.

The second method employed consisted in finding whether the freezing-point lowering of dilute sodium hydroxide solution would be increased by the addition of a dilute hydrogen dioxide solution. As is well known, if we dilute sodium hydroxide solution at constant volume with acetic acid, no freezing-point depression is observed, owing to the formation of a salt. They found that the freezing-point of a ¼ normal NaOH solution was not lowered by the addition of ½ H_2O_2, thus proving chemical combination between the hydrogen dioxide and the sodium hydroxide. The third method was based upon the retardation of the rate of saponification of ethyl acetate by sodium hydroxide solutions, to which hydrogen dioxide had been added. The retardation was found to be proportional to the quantity of hydrogen dioxide present, thus proving that enough sodium hydroxide was removed from the field of action to form a chemical compound with the hydrogen dioxide.



METHOD OF TESTING HYDROGEN DIOXIDE.

Since hydroxyl ions disappear, new anions must be formed from the hydrogen peroxide, and these in turn combine with the sodium to form a salt. Since the molecular conductivity of sodium hydroxide is diminished by the addition of hydrochloric acid, owing to the formation of a salt, Bredig based his fourth method upon the determination of the change in conductivity of a solution of sodium hydroxide to which successive portions of hydrogen dioxide are added. He found in every case that the hydrogen dioxide behaves like a weak acid, such as hypochlorous acid. The fifth and last method employed, is worthy of detailed description, since it can be used as a lecture table demonstration.

In the lower part of the U-tube is placed a two per cent. jelly of agar-agar *a*, which is made a conductor by the addition of potassium nitrate and an alkaline solution of lead oxide, thus forming a plumbate. The super-adjacent layer *b* consists of agar-agar and potassium nitrate, while into the two arms of the tube *c c* is poured an alkaline solution of hydrogen dioxide. Into each arm is then dipped an electrode —these electrodes being made of iron plated with tin in order to prevent the catalytic action which would result were platinum electrodes used. A current of from 0.1 to 0.3 amperes is then passed through the cell in the direction of the arrows, the tube being cooled in ice water.

Now, if the hydrogen dioxide moves as an anion to the anode, it must penetrate the indifferent layer *b*, and upon coming in contact with the surface of separation between *b* and *a* cause the precipitation of brown peroxide of lead. This has been found to be the fact, the precipitate forming as a brown ring at *f*. Thus in five different ways it has been shown that hydrogen dioxide behaves like a weak acid. The attempts that have been made to determine the valence of this anion have not been entirely successful as yet, but the evidence seems to point to variable valence.

Johns Hopkins University.

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High Boiler Pressures.

Prof. Thurston, of Cornell, who is an expert on the steam engine, has been making demonstrations with steam pressures of 1,000 pounds to the square inch, and thinks that these can be safely doubled in the course of time. These would greatly increase the efficiency of the steam engine, which is now well known to be very wasteful, even in its most economic forms.

High pressures are produced by superheating the steam after it is generated, thus increasing its expansive power. In some of the steam automobiles the pressure goes as high as 500 pounds, by superheating the steam. In the common steam boiler, it is easy to see, a large fraction of the heat is lost in raising the water to the boiling point; and it is only the heat which the steam absorbs above that point that counts, all the rest being wasted.

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Radio-Active Emanations of Thorium.

Messrs. Rutherford and Soddy have communicated to the Chemical Society of London the latest results of their study of the radio active emanations of thorium. Thorium sends out a Becquerel radiation and, moreover, communicates to gases in contact with it a radio-active substance which may be considered as an emanation of thorium itself. The power to emit such radiations is destroyed by heating, and is reacquired by reprecipitation. Their latest experiments indicate the presence of some foreign substance—possibly a gas of the argon type—which constitutes the emanation. It is not destroyed by active agents such as platinum-black at a white heat, red-hot magnesium and the like.

TUNGSTEN: THE MINERAL ODDITY.

BY MABEL HERNER.

A backward glance across the early history of Colorado reveals the interesting fact, that for decades past she has given promise of what she is to-day—the acknowledged abiding place of nearly every existing metal. And it may be of some interest to the scientific world to know that, besides a famous producer of gold, silver, and not a few of the other metals of lesser value, she is becoming the foremost producer of a yet rarer mineral—one whose history is perhaps as unique as that of any member of the non-organic world.

It may not come amiss, just here, to quote a brief outline of the subject of this sketch as portrayed by the various standard authorities, prior to the recent discovery in Boulder County, Colorado.

"Tungsten is one of the metallic elements of chemistry. The mineral tungsten (meaning in Swedish, 'heavy stone'), used to be taken for a tin ore until this was disproved by Cronsted. Scheele showed in 1781 that it is a compound of lime with a peculiar acid, the metallic nature of which was recognized in the same year by Bergmann. It occurs only as a component of a number of relatively rare minerals, the most important of which are wolfram or wolframite, $(Fe,Mn)WO_4$, and sheelite (tungsten) $CaOWO_3$ (see mineralogy). The metal is prepared from the pure oxide WO_3, by reduction with hydrogen in a platinum tube at a high temperature. It forms resplendent tin-white or grey iron. It is more difficult to fuse than even manganese. It is unalterable in ordinary air; oxygen and even chlorine act upon it only at a high temperature. Hydrochloric and sulphuric acid do not attack it. Nitric acid attacks it slowly, aqua regia readily, with formation of the trioxide WO_3. Impure tungsten is now being prepared industrially for the production of a peculiar kind of steel."

When it is heated to redness in the open air it takes fire, and is converted into tungstic acid, used largely in the chemical laboratories, where, perhaps, it reatins most largely its individual value. Thus, we gather a perhaps but too remote idea of a metal whose scarcity forbids it being tested as to its best application, and this fact has given rise to the necessity of various substitutes which almost, if not entirely, eclipse its individual commercial value, until larger quantities may be obtained for other and more extensive trials.

The homes of tungsten, as before stated, have been few and far between. Its meagre but interesting history shows that it abides in small quantities in Cornwall, Cumberland, somewhat more extensively in Australia, New Zealand and Nova Scotia.

It has not been known to exist in this country at all, until very recent years, but in the year 1899 its production was 89 long tons of high grade ore, carrying 60%

to 70% of tungstenic acid. In addition, the mines of Lawrence county, S. D., produced 106 tons of ore containing 38% to 50%, which has been the largest production in America; aside, we find, glancing over the mineral statistics, that small veins have been found in Connecticut and Arizona, but in no such quantities as to raise our record in the world's specific market

There is but little about the modest city of Boulder, with its eight thousand inhabitants, its quiet streets and artistic mountain highways and byways, to suggest the phase of industry carried on about it. Indeed, its surroundings, in spite of the great hills which rise on all sides above it, bear a distinct harmony with those old-fashioned New England college towns with their breath of culture and intellectuality in the very atmosphere. Too many sketches have been written of the various mining centres of Colorado to form any unjust idea of the modes of existence carried on within them.

If we should pause to scan once more the story of early Colorado, we should find that long ago—even to the very earliest days of habitation, that many were the "wild west tales" recorded in this very centre. Like all other hamlets of this once wild and rocky land, she has seen her flood and ebb of gilt and glitter; and, too, as other memorials of pioneer days, she fell asleep in the decline of the 70's, but, unlike others, began a growth entirely dissimilar, and for over 30 years has been a home of education,—a home where the hopeless have been called to life anew, a home of the artist, and the romancer of legitimate fame.

In decades past—a story runs—a solitary wanderer plodding the depths of the vast wilderness crossed a valley of untold gold. He had lost his way and for weeks and months roamed about at the mercy of fate He gathered up as much of the treasure as he could carry, and coming at last upon the camp of Denver, told his story. The valley of gold was never recovered, and after a long time the little camp at the foot of the famous "Red Rocks" was abandoned so far as mineral industry went.

Through the mists of years that old legend has clung to it still, and,—who can tell?—it may have been the inspiration that guided the gold seekers of modern years to renew the efforts of over a quarter of century ago. At any rate, it has been awakened to something of its former activity and is substantially rewarding the efforts of mankind.

The first indications of Tungsten in Boulder county were discovered along the walls of an abandoned silver mine about a year ago. At first it was supposed to be a form of iron, and was mined for such, but when it became known what it really was, "The Great Western Exploration and Deduction Company" became interested in it, and, securing the property, began working it. The vein varies from six inches to six feet (the largest deposit known in this country), and during the course of the year, 200 tons of concentrate wolfram ore has been removed which carried from between 60% to 65% of pure tungsten or 80% of metallic tungsten. Half of this ore has been distributed in America, the other half shipped to Europe.

As for the mine itself, it is worked entirely after the method of silver and gold properties, shafts have been sunk, tunnels been advanced to cross-cut the various veins, and every indication is given of yet larger quantities beyond. Speculator sare becoming intensely interested in its future from the principal fact, perhaps, that the metal is able to undergo that high heat necessary to mould it in various forms and yet retain its temper—a faculty unknown to any other metal.

What the prospects of this mineral oddity are, of course is largely based on its abundance, and it will be watched with interest by the various scientists who for years have regarded it in the class of "the rare minerals."

Alcohol Motors.

At the instance of Emperor William the German government has offered three prizes aggregating $4,500 for the best motor wagons for military purposes, to be run by alcohol explosion engines. These motors must be made in Germany, weigh less than 8 tons and be capable of drawing a load of 16 tons on good roads. They must also be able to go unloaded across plowed fields and through water 18 inches deep.

The German government never fails to improve its army whenever possible.

Temperature of the Sun.

A new determination of the effective temperature of the sun which has been made by Dr. W. E. Wilson, F.R.S., gives the value 6863° C. (absolute), after making allowances for absorption in the atmospheres of both earth and sun. By the expression "effective temperature" is meant that uniform temperature which the sun would have to possess if it had an emissive power equal to unity, at the same time giving out the same amount of radiant energy as at present.

Red Linings Protection from Sun's Rays.

A writer in the St. James's Gazette, speaking of the advantages of red linings as protection against the sun's rays, says: I think it was Colonel Maude who advocated red lining to one's hats and jackets. We live by the river, and are on it in the hottest months of the year, and used to suffer from sun headaches. Since we adopted red sun shades and the same colored lining to hats and blouses we find no inconvenience from the chemical rays of the sun, and are able to enjoy even the heat wave without discomfort or possible chance of sunstroke.

International Congress of Americanists.

The thirteenth session of the International Congress of Americanists will be held in the halls of the American Museum of Natural History, New York City, October 20–25, 1902. The object of the Congress is to bring together students of the archæology, ethnology and early history of the two Americas, and by the reading of papers and by discussions to advance knowledge of these subjects. Communications may be oral or written, and in French, German, Spanish, Italian or English.

All debates are expected to be very brief, and no paper must exceed thirty minutes in delivery. The papers presented to the Congress will, on the approval of the Bureau, be printed in the volume of Proceedings. Members of the Congress are expected to send, in advance of the meeting, the titles, and, if possible, abstracts of their papers, to the General Secretary. The subjects discussed by the Congress relate to: I, The native races of America, their origin, distribution, history, physical characteristics, languages, inventions, customs and religions. II, The history of the early contact between America and the Old World.

All persons interested in the study of the archæology, ethnology, and early history of the two Americas, may become members of the Congress by signifying their desire to Mr. Marshall H. Saville, General Secretary of the Commission of Organization, American Museum of Natural History, New York, and remitting either direct to the treasurer (Mr. Harlan I. Smith, American Museum of Natural History), or through the General Secretary, the sum of three dollars im American money. The receipt of the Treasurer for this amount will entitle the holder to a card of membership and to all official publications emanating from the thirteenth session of the Congress. Mr. Morris K. Jesup is president, and Duke of Loubat, vice-president of the Commission of Organization.

Diamonds in Alaska.

Letters were received from Cape Nome saying that genuine diamonds varying in weight from one-half carat to a carat have been found in placer deposits on tributaries of Golovin Bay, forty miles east of Cape Nome. Miners found the diamonds while washing out gold. Several times heretofore discoveries of diamonds have been announced from Alaska. Returning miners have reported picking up small transparent white stones along the canyon beds of the coast further south. Later they became convinced that they had thrown away genuine specimens in the rough.

Henry Hanks, former State Mineralogist of California, last summer made a microscopical examination of the sands along Cape Nome beach, finding therein minute diamonds.—Sun.

Hall's Journal of Health

Founded by Dr. Wm. M. Hall, 1854.

THE OPEN AIR TREATMENT OF PULMONARY TUBERCULOSIS.

BY PROF. WARREN K. MOOREHEAD, A.M.

It requires some presumption on the part of a layman to prepare an article on the treatment of tuberculosis However, as this is for the lay reader and not for those who know vastly more regarding the subject than I do—and there are many such—I make bold to briefly describe the treatment now so popular in the Adirondacks and elsewhere in the United States.

Some five years ago I was told that I was in "an advanced stage of consumption," and accordingly I went to the Southwest and spent, first, a winter in New Mexico and subsequently a winter in Arizona, in search of health. At that time the rest cure was not extensively practiced in the Southwest, but recently, so I am informed by physicians who are experts in pulmonary matters, the old theory that one must exercise, and yet again exercise, has given way to the new doctrine that cure is effected by diet and rest. Any layman of intelligence who has personally investigated the treatment in the West, in the East, and in the South will, I think, take the position that the Adirondack cure and similar treatments followed in Switzerland and Germany is the most efficacious in the treatment of this widespread disease.

The essential points may be known to many readers of POPULAR SCIENCE NEWS, and I shall therefore confine myself to a few details which may have escaped observation.

The point insisted upon by physicians in the Adirondacks and elsewhere is that while it is better for one to change climates and to seek an altitude of two or three thousand feet, yet this is not absolutely necessary. Many persons unable to visit the mountains can take the cure in their own homes, and in most instances the patients are benefitted and the disease arrested, and in not a few instances permanent cures have been effected. I have in mind cases of patients in Philadelphia and Cincinnati who took the cure at home, and so far as I know, were restored to perfect health.

The fundamental principles of the rest and diet cure are almost apparent through the terms. That is, rest means to free one's mind from all cares and anxieties and business, and to give one's whole attention to recovering one's health. Nearly every residence, either large or small, has a porch. One should sit out from six to eight hours daily on this porch, with sufficient blankets in cold weather so as to preclude the danger of catching cold. If the porch is enclosed in glass, so much the better, but where such facilities are not at and in stormy weather it is better for the patient to remain indoors. These porches are of simple construction. A glass frame is fitted to the end of the porch and along the side for six or eight feet. The house forms the third side, and the fourth is left open. Thus the same temperature as that of the surrounding air is maintained and there is no draft. Where one is anaemic or weak, hot water bags or soap stones may be frequently used to keep the feet warm.

The chief danger of infection in tuberculosis is from the sputum. It is positively criminal for a consumptive to expectorate upon the ground or in ordinary receptacles where the discharge may dry and millions of bacilli be released to do untold damage. Fortunately, but few persons are infected compared with the number of germs thus released. It is nothing short of a miracle that in so many houses where no precautions are taken, the sick member of the family does not infect the entire household. If the cardboard cups (which are to be burned in the stove every evening) cannot be obtained, a patient should be very careful to either burn the sputum, or, where they expectorate in water, make such disposition of it that there shall be absolutely no danger. As long as the discharge is kept wet there is no danger. The germs are released through its becoming dry.

One should sleep with all windows open, or as many opened as is possible without creating a draught upon the patient. The absolute rest, the mind occupied with light and pleasing literature, freedom from all unpleasant subjects—all these things combine to effect one far more favorably than the average reader would imagine.

As to the diet, the authorities maintain that one should eat very heartily of all nutritious foods, and even take two or three lunches between meals. Indeed, one should eat all that the stomach will assimilate. The diet is varied in certain cases, but so far as a general rule may be established, the following are highly recommended: Steaks, not too well done, eggs, butter, cream and milk, in large quantities, toast, rice, the various cereals, fresh vegetables, fish, etc. For emaciated patients, many of the various compounds of phosphates, cod liver oil, mixed fats, beef, iron and wine, etc., are recommended, most of which are good, and all of which are great heat and fat producers.

All of this may seem very simple and trivial to those sufferers who expect great things through some "wonderful cure" such as the various lymphs, inhalers, electrical treatments, and the thousand and one agencies of the charlatans, whereby they take advantage of suffering men and women to enrich their own coffers. Careful and accurate statistics, maintained for more than twenty years in the Adirondacks, prove to any person of scientific bent, that so far there has been discovered no "cure all" equal to the simple and efficacious remedy of pure air, absolute rest, nutritious food and contentment.

Consumptives may be roughly divided, for the benefit of the laymen, into two classes: the hemorrhagic and the fever cases. The former is the more easily cured of the two, although a hemorrhage usually causes great consternation among the friends of the patient, and not infrequently sets the house in an uproar. All excitement should be avoided, as such only tends to aggravate the symptoms. The faster and stronger the heart action, the heavier the hemorrhage. Many cases are subject to homorrhages. These discharges really benefit the lungs, and, save in the secondary or advanced stages of the disease, need not be feared. Continuous fever is far more dangerous. After a hemorrhage one is kept absolutely quiet for forty-eight hours, in order to permit a substantial clot to form and prevent a second hemorrhage. Stimulants should not be given. A physician should be sent for at once, and his advice followed.

Continuous high temperature indicates a very inflamed condition of the lungs, and it is a part of the rest cure to keep fever cases absolutely quiet. That is, they should not walk further than from the room out to the porch. They should have reclining, or steamer chairs, and be relieved of unnecessary steps. If they can lie upon a cot, and it can be rolled or carried from the room to the porch, and returned in the evening, so much the better. A few days rest may allay the fever.

The experts in tuberculosis insist upon what strikes the casual observer as a very important and necessary thing, namely, that the local physician should recognize tuberculosis in its incipiency, and either put the patient on the rest cure at home, or send him to the mountains without unnecessary delay. In the Adirondacks there are hundreds of persons who have been sent there in secondary or advanced stages of the disease, who were told by the local physicians that they were incipient cases. With the stethoscope it is not difficult for even an unskillful doctor to detect the first symptoms of active pulmonary tuberculosis, and yet hundreds of doctors everywhere make this very grave mistake, and people come to the mountains only to ascertain that they have come too late.

Better for one who "feels a little run down" to come too soon, than to wait until a large portion of either lung is involved. Incipient cases can be cured easily. The percentage of cures of incipients is very high. The percentage of cures of advanced cases is low. Far advanced cases may have their disease arrested, but a positive cure is exceedingly rare; therefore, it behooves anyone who thinks he is in a weakened condition to guard himself with care, and if signs of this dread disease be found, he should begin the rest cure at home, if he be not able to go to the mountains, without delay.

A New Treatment for Colds.

Dr. L. Duncan Bulkley gives a successful method for a common cold, based on the theory that there is an acid condition of the system developed, which is sufficient to irritate the terminal endings of the nerves in the skin and mucous membranes, and so to render them susceptible to impressions of cold by a derangement of the capillary circulation. As this acidity is neutralized the normal conditions return.

For an adult of medium size and weight twenty to thirty grains of bicarbonate of soda are given in two or three ounces of water every half hour, for three doses, and a fourth dose at the expiration of an hour from the last one. Two to four hours are then allowed to elapse, to see the effect, and the four doses are repeated, if necessary, as is frequently the case. After waiting two to four hours more the same course may be taken again, although this is not often required, if the treatment has been begun early in the course of the "cold."

To be promptly effective, this treatment should be begun with the earliest indications of coryza and sneezing, and it has rarely failed to break it up, even in those much inclined to the same. After the second or third day it acts less promptly, and more frequent repetitions are needed.

Fruit Beneficial.

Anyone who likes fruit will make a point of eating it daily, and even on occasions to make a meal entirely of it. One cause why ripe and wholesome fruits are given a bad name is because they are eaten at the wrong end of the meal. After many courses of heavy foods and strong drinks a few harmless strawberries are indulged in, and then, when these rich foods and stimulating drinks upset the stomach, the blame is put on the innocent strawberry. The real place for fruit is at the beginning of a feast, and not at the end. A better plan is to make a meal of bread and ripe fruit. The best meals to make thus are breakfast, lunch, or early tea. The bread should be brown and dry, and the fruit ripe and raw.

Ubiquitous Microbes.

Bacteriologists destroy one by one our fondest illusions. Hitherto the man in the street had imagined that were all the waters of every city and plain polluted he would still find immaculate springs in the Alps. But M. Binst, who presides over a chemical laboratory at the Pasteur Institute, having no such faith, obtained some ice from the glaciers of Mont Blanc itself and placed it under his pitiless microscope. His verdict shatters the dreams of mountaineers. It appears that even the summit, which so long remained untrodden by human feet, has lost its purity, if it ever had any. The ice in question, and water melted therefrom, were found, on bacteriological analysis, to be "peopled with colonies of microbes." The statement which follows is particularly terrifying. It appears that "the germs in question were found to belong to the most varied families of bacteria." M. Binst accounts for the pollution of the Mont Blanc glaciers by surmising that the microbes have been conveyed to the mountain peaks by the winds sweeping the cities in the valleys.

Olive Oil as Food and Medicine.

In all those cases where there is indigestion of starchy foods, olive oil supplies the system with a ready heat and force-making food. It appears to exert a direct alterative influence in constitutional diseases, more especially where there is a derangement of the liver and kidney functions. Neuralgic nerves are greatly benefited, sometimes permanently cured, by the steady use of olive oil.

Carbuncles.

A carbuncle may be arrested in its development by the injection into different parts of the tumor of five drops of pure liquid carbolic acid at each point.

Effect of Electric Light on the Eyes.

A Russian medical man has decided that electric light is least injurious to the eyes. He says that the oftener the lids are closed the greater the fatigue and consequent injury. By experiments he finds that the lids would close with different illuminations per minute, candle light, 6·3; gas, 2·8; sun, 2·2; electric light, 1·8.

Vaccination.

A Sanitary Inspector says, the vaccinal scar can be accepted only as evidence of a former vaccination, but whether the mark is distinct or faded is no trustworthy indication whether you remain protected. The best guaranty of safety is vaccination in infancy, a second vaccination at the age of ten or twelve, and thereafter an occasional test vaccination to determine whether immunity remains unimpaired.

Bundling Up.

The general practice of turning up the collar and bundling up the neck is wrong. If one is to take a long cold ride protection is necessary, but the throat and neck should be taught to consider itself a part of the face and to react and protect itself against momentary or any ordinary exposure out of doors. The wearing of chest protectors is another error which is conducive to tenderness, colds and ill health, and so is the wearing of chamois, or any other form of impermeable undergarments next to or anywhere near the skin.

Insufficient Nourishment.

There is no doubt whatever that want of food is at the basis of many insidious diseases. How the thoughtful man rebels at the idea of iron, strychnia and cod liver oil, when beefsteak and butter and bacon would be so much better and afford some satisfaction to the poor victim unwittingly suffering from want of enough to eat. May the number of physicians who recognize this patent fact increase year by year, is the prayer of those who are engaged in instructing them, and who have the good of the human race in their hearts.

Sterilized Milk.

Dr. Romme, in La Revue, describing modern efforts to find a substitute for human milk for infants, says that sterilized milk has failed because it lacked certain "ferments" found in the human milk, and apparently almost vitally important to children. But recent experiments, conducted by M. Spolverini, have proved that by regulating the food of a milch cow, for instance, its milk can be assimilated to human milk. He experimented first with a goat by feeding it on ordinary food, but adding eggs or a little meat; and later on he experimented with another goat by giving it sprouting grains of barley. In each case chemical examinations of the goat's milk showed that its constituents were exactly those of human milk.

Insects as Food.

Scientific men and certain savages are aware that insects may serve as palatable food. M. Dagan, a French entomologist, has tried several hundred species, both raw and cooked in various ways, and has further made himself an authority by collecting travellers' experience. Spiders, which he has eaten, he does not recommend. Cockroaches, however, make most delicious soup; caterpillars are light and easily digested, and are relished not only by African and American natives, but by Frenchmen; and locusts, fried or made into flour and boiled in milk, are prized by the Bedouins. Cambon, the Jesuit father, suggests that locust flour might become a popular condiment in Europe.

Yellow Journal Science.

In glancing over the vividly illustrated pages of the Sunday yellows, one is inclined to favor the appointment of a press censor to pass upon certain features to be found in their bulky issues. The strenuous efforts made by these journals to popularize science would be ridiculous if the results were not really pernicious. The distorted views given to the public are worse than no information at all. The reader is given a gross misconception of the subject under discussion. No subject is sacred from the touch of these "popularizers."—Washington Post.

Pompeii.

Experts say that the buried city of Pompeii has not yet yielded up half of its artistic treasure; that at the present rate of progress seventy years will elapse before it is thoroughly unearthed.

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OUR FORESTS.

Just at present there is much agitation regarding the preservation of our forests. The enormous demand for paper alone denudes countless acres of fine timber lands annually, to say nothing of the great amount of lumber used for other purposes, and naturally considerable anxiety is felt. Lately, there has been before the house at Albany a bill to permit the condemnation of streams for the convenience of the lumbermen in the forest reserves. The Adirondack League Club is strongly opposing this measure, and it is hoped they may be successful. If the permission were given, not only would the grand forests suffer, and serious spring freshets occur, but the streams would be ruined for fishing purposes, upon which thousands of dollars have been expended for stocking. Although all nature lovers deprecate the slaughtering of the beautiful trees, it must be remembered the increasing population requires not only more and more land, which means inroads in the forests, but the lumber for building purposes. Legitimate use of the land of forest trees is all very well, but wanton waste usually follows the woodman's axe; felling trees without discrimination as to their age or size does the greatest damage.

It would seem good common sense to leave a few of the trees, possibly one out of every three; this might prove beneficial, just as a judicious pruning of fruit trees enables them to derive more benefit of the sun's rays and produce more fruit. While this method may not solve the problem of supplying the constantly increasing demand for lumber, it would preserve the beauty of the forest. On the other hand, completely denuding the forest only means making a place for a new one, if we leave it unmolested for a long enough period. From a practical point of view, a virgin forest is of no use to the public; seen and enjoyed by only a few, if any, it must be acknowledged that it is a loss to the human race, except, as before mentioned, nature's preventive of freshets in the early spring and drought in the summer.

Speaking of the appearance of the forest, the Forester says: "A culled forest is not so inferior in appearance to an old one, and it is surprising how much of what already passes as old among the uncritical was plainly young fifty years ago. To call aloud for the forester, while inveighing against the admission of the axe to the woods which he is to manage, is simply to multiply contradictions, and to heap obstacles in the path of the only sort of forest preservation which is attainable."

The best method yet devised is undoubtedly using common sense discretion in the selection of trees to be felled, so as to avoid clearings as much as possible, and where this is impossible, allow trees to grow up again.

◆

THE HEAVENS FOR MAY.

BY PROF. MALCOLM McNEILL.

The familiar summer constellations are beginning to show themselves above the eastern horizon. The milky way lies nearly parallel to the horizon, the northern part somewhat above in the northeast, and farther south in the southeast one branch is just rising. It is, however, too faint to be well seen until toward midnight when it is well up toward the zenith. Cygnus is on the horizon in the northeast with Lyra above and a little farther toward the south. Hercules is well above the eastern horizon, while Corona and Bootes are above, reaching nearly to the zenith. Scorpio, the finest of the exclusively summer constellations, is rising in the southeast. Above it are Libra and Virgo, the latter just coming to the meridian about half way between zenith and south point. Leo is high up in the southwest. Below and farther west is Cancer, while Gemini is on the horizon a little north of the west point. Canis Minor is south of Gemini and is setting. Ursa Major is just west of the meridian between the pole and zenith, and Auriga is low down in the northwest. Cassiopeia is between the pole and the horizon, but its principal configuration is made up of bright enough stars to be seen when at their lowest point.

Phases of the Moon, Eastern time:

New Moon.	May	7,	5 h. 45 m. P.M.
First Quarter,	"	14,	8 h. 40 m. A.M.
Full Moon,	"	22,	5 h. 46 m. A.M.
Last Quarter,	"	30,	7 h. 0 m. A.M.

The sun will be partially eclipsed on May 7, but the phenomenon is visible only in the south Pacific Ocean; the only land of any consequence from which it can be seen is New Zealand, and that island is just within the shadow track. The greatest magnitude of the eclipse is 86% of the sun's diameter, and it attains this magnitude only in extreme polar regions below 70° south latitude.

Most of the planets still remain out of range of evening observation; but Mercury will give toward the close of the month the best opportunity of the year for naked eye view. It passes superior conjunction on April 28 and perihelion on May 4, and comes to greatest east elongation on May 28. Its apparent distance from the sun will then be more than 23°; this is 5° greater than at the eastern elongation in February, which occurred only three days before perihelion passage. From May 10 until nearly the middle of June the planet will remain above the horizon more than an hour after sunset, and for the last ten days in May the interval will be nearly two hours. It will then be somewhat conspicuous in the evening twilight, although, of course, not nearly as bright as Venus in a similar situation.

Venus is still a morning star and rises throughout the month about two hours before sunrise. The interval increases about eight minutes during the month, although the distance between the planet and the sun diminishes 2¼° between May 1 and May 31. Other things being equal, this would cause a diminution of about ten minutes between the rising of the planet and of the sun; but the greater relative northward motion of the planet causes an acceleration in the time of its rising, which more than counterbalances the diminution due to a smaller distance from the sun.

Mars is still too near the sun for naked eye view, and will remain so for some months. Even at the end of the month it rises less than an hour before sunrise, and as it is at nearly its greatest distance from the earth, it will not be possible to see it with the naked eye. On the early morning of May 7, the moon passes very close to it, and there will be an occultation of the planet, visible only in the equatorial regions of the Atlantic Ocean.

Jupiter rises at a little before midnight at the end of the month, two hours earlier than at the beginning. It is therefore getting into position where it can be seen by anyone who cares to sit up late. It is in quadrature with the sun on May 7, and moves about 2° eastward in the constellation Capricorn. The motion is only about half of that in April, and by the end of May the planet is nearly stationary.

Saturn rises at 12.39 A.M., on May 1 and at 10.37 P.M., on June 1. It is therefore in a somewhat better position than Jupiter for observation. It lies between Sagittarius and Capricorn and moves westward (retrogrades) about 2° during the month. In its retrograde motion it will retrace almost precisely the same path it made during its eastward motion. As seen in the telescope the rings are gradually narrowing, and the difference will be quite noticeable when compared with last year's appearance.

Uranus rises at about 10 P.M. on May 1 and at 8 P.M. on May 31. It will be high enough to be in good position for observation before midnight. It is in the southern extension of Ophiuchus, between

Scorpio and Sagittarius, and moves a little more than 1° westward during the month. On June 1 it is a little less than 2° north of the third magnitude star *theta* Ophiuchi. A sixth magnitude star in the same constellation, north and east of *theta*, is still nearer the planet, and does not differ greatly in brightness.

By the close of the month Neptune, which is still an evening star, will set before 9 P.M. It is in conjunction with Mercury on the morning of May 29.

Correspondence

Inventor of the First Steamboat.

Editor POPULAR SCIENCE NEWS:

The article on Advancement of Applied Science in your April number was read with interest, but I wish to enter my dissent from that portion of the article which relates to the invention of the first steamboat, which the author states was built in 1801 by William Symington. It is a well-established fact that this honor belongs to John Fitch, of Windsor, Conn. The late Dr. William Wood, a townsman of Windsor, devoted a great deal of time through many years in gathering the facts respecting Fitch and his experiments with steam as applied to propelling vessels, and published in the Hartford Times of April 19, 1883, the results of his research, from which are taken the following items:

April 15, 1785, John Fitch first conceived the idea of steam as a motive power for carriages, but soon turned his attention to its application in moving vessels, and says: "I was then altogether ignorant that a steam engine had ever been invented. The propelling of a boat by steam is as new as the rowing of a boat with angels, and I claim the first thought and invention of it." His first model was tried on a small stream on Joseph Longstreth's meadow in Southampton township, and it realized every expectation. Afterwards he exhibited the model to Dr. John Ewing, provost of the University of Pennsylvania, who gave Fitch a letter to William C. Houston, formerly a member of Congress, of which the following is a copy:

> Philadelphia, August 20, 1785.
>
> Dr. Sir:—I have examined Fitch's machine for rowing a boat by the alternate operation of steam and the atmosphere. The application of this force to turn a wheel in the water so as to answer the purpose of oars, seems easy and natural by the machine which he proposes, and of which he has shown me a rough model.

August 29, 1785, Fitch presented the following letter to Congress:

> "The subscriber begs leave to lay at the feet of Congress an attempt he has made to facilitate the internal navigation of the United States, adapted especially to the waters of the Mississippi. The machine he has invented for the purpose has been examined by several gentlemen of learning and ingenuity, who have given it their approbation."

March 18, 1786, the State of New Jersey gave Fitch the exclusive right to construct, make, use or navigate all and every kind of boats impelled by force of fire or steam within the jurisdiction of the State.

July 20, 1786, Fitch tried experiments on a skiff with a steam engine of 3 inch cylinder, which was a failure, and provoked by the scoffs and insults of the spectators he went to a tavern, and says "he used considerable West India produce that evening." Next day he was much ashamed of himself, and retired early. Says Fitch, "about 12 o'clock the idea struck me about cranks and paddles for rowing a boat, and for fear I should forget or lose the idea, I got up about 1 o'clock, struck a light, and drew a plan. I was so excited that it was impossible to sleep." The experiment was made in a skiff, July 27, 1786, and worked satisfactorily.

Fitch had exhausted his means and applied to the Pennsylvania legislature for a loan of £150, and failing to get it, wrote the following letter to General Thomas Mifflin, then speaker of the House:

> Honored Sir:—I am of the opinion that a vessel may be carried 6, 7 or 8 miles per hour by the force of steam; and the larger the vessel the better it will answer; and am strongly inclined to believe that it will answer for sea voyages as well as for inland navigation, which would not only make the Mississippi as navigable as tide water, but would make our vast territory on those waters an inconceivable fund in the treasury of the United States.

In 1787, the following States granted Fitch exclusive rights to their waters for the purposes of steam navigation: New York, March 19, 1787; Delaware, February 3, 1787; Pennsylvania, March 28, 1787; Virginia, November 7, 1787.

Fitch's second boat was perfected in 1787. This boat was 45 feet long, 12 feet beam, and had six oars or paddles on each side. Engine was 12 inch cylinder. The trial took place August 22, 1787. The convention to frame the Federal Constitution was in session at Philadelphia at the time and nearly all the members witnessed the success of the steamboat. Chief Justice Oliver Ellsworth, of Connecticut, was on board the steamer.

Another boat, 60 feet long, 8 feet beam, was built, which made several trips from Philadelphia to Burlington (about 20 miles). On the 12th of October, 1788, there were 30 passengers aboard when the trip 20 miles up stream was made in three hours and ten minutes. This speed did not satisfy Fitch, and another boat was built with larger machinery—engine 18 inch cylinder instead of 12 inches. This boat attained a speed of 8 miles an hour.

On the 16th of June, 1790, Governor Thomas Mifflin and the Supreme Executive Council were passengers on this boat, and so highly pleased were they, that they presented the steamboat company with a suit of flags, the cost of which was £5. 6s. 11d.

This boat was now run as a regular passenger boat between Philadelphia and Burlington. The two papers published in Philadelphia, the Pennsylvania Packet and the Federal Gazette, gave notices of the days and time of sailing:

> "The steamboat is now ready to take passengers, and is intended to set off from Arch Street Ferry, in Philadelphia, every Monday, Wednesday and Friday, for Burlington, Bristol, Bordentown and Trenton, to return on Tuesday, Thursday and Saturday."—Pennsylvania Packet, June 15, 1790.

The same notice was published in the Federal Gazette, June 14, 17, 19, 22 and 24, 1790. In the New York Magazine is an extract from a letter dated August 13, 1790—Fitch's steamboat really performs to a charm.

Working now, to construct a boat that would carry freight as well as passengers, a larger boat was contracted for with the intention to be used on the Mississippi River. It was named the Perseverence. When nearly completed, a violent storm arose, breaking it from its moorings, and it was blown upon Petty's Island, in the Delaware, opposite upper Philadelphia. The stockholders became discouraged and refused to advance any more funds, and the boat was abandoned. August 26, 1791, the Federal Congress ordered that "letters patent be granted to said John Fitch for his aforesaid inventions for the term of fourteen years"

This was signed by General Washington and Commissioners Thomas Jefferson, General Henry Knox and John Randolph.

In 1793, Fitch went to France, returning in 1794 to East Windsor. In 1796, he constructed a steamboat from a ship's yawl. This was moved by a screw propeller on a fresh water pond in New York City, called the Collect. This pond was afterwards filled and embraces the ground on which stands the Tombs and adjacent buildings.

Fitch died at Bardstown, Ky., 1798, a disappointed, discouraged man, by his own hand, some time between June 25 and July 18.

In respect to the others mentioned in your paper. Symington was 12 years after Fitch was running his boat regularly carrying passengers. Stevens had been a passenger on Fitch's boat, and Fulton had, in 1786, all the specifications and drawings of Mr. Fitch in his possession for several months, and in 1801 was a passenger on Symington's boat on the Forth and Clyde Canal.

The exhaustive article by Dr. William Wood on "Who First Successfully Applied Steam for Propelling Vessels," has many interesting side lines of investigation going back to the first claimant, Blasco de Garay, a Spaniard who exhibited to the King, in the year 1543, a boat propelled, "even in a calm without the aid of oars or sails," and down to the claim of Robert Fulton, 1803.

The state of Connecticut has honored

the name of Fitch, erecting in its capitol building a bronze tablet to his memory as the inventor of the steamboat. JUSTICE.

[NOTE.—The article by Dr. Wood is printed entire in the June (1863) number of The Locomotive, published by the Hartford Steam Boiler Inspection and Insurance Company.]

Falling Trees, Etc.

Editor POPULAR SCIENCE NEWS:

It may interest some of those who followed or took part in the recent discussion of the falling of dead trees, to know that the poet, Street, himself a keen observer, and the author of some of the daintiest nature notes ever penned, long ago recorded the tendency noted by your correspondents. In his "Gray Forest Eagle" he speaks of the bird living unchanged to see the pine spring up from the seed, flourish, die, and wither,

"Till it rocks in the soft breeze and crashes
to earth,
Its brown fragments strewing the place
of its birth."

This indicates that he thought it common for dead trees to "choose a comparatively still day on which to fall."

Mr. Verrill was indeed fortunate in securing the series of photographs of the last transformation of the cicada, which appeared in your December issue. The data accompanying them is also interesting and valuable.

But I must disagree with him on one point: instead of occurring in the early morning, as he says they usually do, all of these transformations which I have observed took place about sunset. I cannot think that they were more unusual and further from the regular time than the one he witnessed at mid-day.

The Meadow Lark comes here very early some years, and appears to begin nesting operations at almost any time. One season my brother reported finding, while plowing for oats in March, what seemed to be young birds just able to fly. Mr. Miller's "usual complement of four eggs" would seem small here, however, six being much more common, while I have known the number to exceed ten, late in the season.

Mr. Hornaday's success in eliminating a great mass of scientific "hearsay" from the text-books by proofs of personal observations utterly inconsistent with it, has made many students unduly skeptical about whatever is not confirmed by their own senses.

Nothing was further from my intention than the "wronging of the Catbird," of which Mr. Gleason accuses me. I live a long way from New Hampshire, and the birds may differ somewhat in their habits. But the Catbird is always versatile, and a promiscuous feeder. I have not yet seen him eating tent-caterpillars, but Mr. Gleason could not live long in the vicinity of an Illinois cherry tree without knowing that our friend in gray likes cherries.

As to bee-eating, I never caught him at that but once, but I was living on the same lot with about ninety swarms at that time, and knew a little about bee-keeping myself. The sight was a surprise to the three or four who saw it, including my father, who was an experienced bee-man.

The Kingbird is surpassed as a bee-eater by a smaller bird (perhaps the Least Flycatcher), but out here I never heard of toads giving any trouble if the hives were raised, as they should be for dryness and ventilation, a foot or so from the ground, on lines of scantling.

I think I never found more than two eggs in the nest of the bittern, common here, but cannot be sure it is the species to which Mr. Gross refers.

M. VICTOR GOODRICH.

Frog Movement.

Editor POPULAR SCIENCE NEWS:

My note books record an odd habit of our common frogs. Our house was on a hill that rose abruptly from the lake, then sloped slowly towards a swamp in the rear of the place. I was sitting on the top of the bank, dreamily smoking, one cool evening late in the fall, when I became aware of a kind of general movement going on around me.

Whatever it was came up from behind me, and going over the bank would end up with a splash in the lake. It was pitch dark so I could not see what was going on, but I could hear the steady movement lake-wards for over an hour. The next evening I turned out with a dark lantern and soon discovered what was happening. It was frogs of all sizes bound for the lake, and my notes say that for the last four years this has been going on.

Just as soon as the nights begin to get cold and raw, the frogs leave swamp and meadow and travel to the lake. At first I thought they left the shallow water of the swamp for fear of being frozen in, but the frogs had all disappeared long before anything froze over. Then I thought that perhaps the lake water was warmer than that of the swamp, but cold weather is more liable to send a frog into the mud than on a quarter of a mile hop to warmer water, and they were surely as safe in the mud of the swamp as in the open water of the lake. There is a creek that runs from the swamp to the lake, but it takes a roundabout course on account of the hill, but I have never known the frogs to use this route, they always hop along in a straight line over the hill. This evening march generally lasts about a week, just before the frogs turn in for the winter.

C. WILLIAM GROSS.

Prof. Von Schroen's Crystals.

Editor POPULAR SCIENCE NEWS:

It was reported a year or two ago that Prof. Von Schroen had found that crystals, when first forming, acted as if alive, —no new thing in seemingly spontaneous movements of inorganic particles, as for example in the "Brownian movements." The Professor, or his reporters, even talked of crystals as really alive; and this absurdity is repeated again occasionally with variations and embroiderings. Subsequently, it came out that the observations were not on mineral crystals, but organic. Diamonds, least of all could have been brought under laboratory examination in the act of genesis; for they are produced artificially only in an enclosed space under intense heat and extreme pressure. G. T. P.

A Moonlight Rainbow.

Editor POPULAR SCIENCE NEWS:

A rainbow by moonlight appeared on the night of Dec. 3d, 1901, at Caleb, in the valley of Mountain Creek, Wheeler Co., Oregon. Caleb is in longitude 43° west from Washington, D. C., and midway between parallels 44° and 45° north. Is well up towards the sky, but the elevation is not known to me.

Mrs. M. M. Derr, correspondent of the Wheeler County News, writes of this occurrence: "About six o'clock, just as the moon arose over the mountains, there appeared a most beautiful rainbow, a very large one; it extended from north to south and threw a lovely arch over the Mountain Creek valley. It was the most magnificent thing, of the kind, that I ever saw. Those who have reached the three-score and ten mark in life say they never before saw a moonlight rainbow." I am three-score and twelve, and I never saw one.

F. S. MATTESON.

Oldest Engine in Use.

Not long ago an original steam engine of Watt's make was taken down at a London brewery, where it was in use 102 years, and sent to the museum at Sydney, Australia, as an exhibit. Probably the oldest engine now in use is one employed for hauling up coal out of a mine at Rutherglen, Scotland, which has been at work ever since 1809. This engine is a curiosity, as it is the last survivor of the old Newcomen type of engines, now long since superseded.

The cylinder is 3½ feet in diameter and 6 feet high and the fly-wheel is 15 feet in diameter. It is a ponderous but simple machine, and the cost of repairs on it since it was first started has been almost nil. Like all the early engines, it is a condenser; for high steam pressures were undreamed of till a comparatively late date in the history of the steam engine.

The valves are worked by hand instead of automatically. The steam in the boiler does not go above the pressure of the atmosphere. A boy turns a cock and lets some of this steam into the engine cylinder and the piston slowly rises. When the end of the stroke is reached the boy shuts off the steam and opens another cock which admits cold water to the cylinder. This condenses the steam and forms a partial vacuum, which causes the piston to descend.

Questions and Answers

QUESTIONS NOT ANSWERED.

Answers are solicited, especially for all questions so far without replies. Questions will appear but twice, successively. Those unanswered will then be designated by numbers. The following, need reply —297, 309–11, 318, 333, 338, 342-3, 350.

355. Fireproofing Wood. What is the cheapest and readiest method of rendering wood practically fireproof?

CARPENTER.

356. Heating Water in Quantity. Is there any domestic way of heating a boiler-full of water, or a large panful, without making a kitchen-range fire? S. L.

357. Field Larks and Grackles in Winter. Is it common or rare to see Field Larks (called Meadow Larks) and the Purple Grackle in mid-winter as far north as the latitude of New York? SUBURB.

358. The English Sparrow vs. Other Birds. How is it that the English Sparrow is said to drive away other birds? I have watched birds for years and have never seen the English Sparrow molesting other birds, but rather, as this winter, mingling in a friendly way with them, apparently delighted to have their company.

SUBURB.

359. Incandescent Lamps. Do incandescent lamps increase in candle-power, and for what length of time, before they decrease? J. S. S.

360. Tarnished Brass-work. How can the old lacquer be removed and tarnished lamp fixtures be restored to original brilliancy? What lacquer is used?

J. S. S.

361. The Red Spot on Jupiter. Is it really permanent and stationary, and what is it supposed to be? X.

362. A Silhouette Party. How is this arranged and conducted? I have seen it mentioned. J. KNIGHT.

363. Hydrogen. Is there any substance or salt that contains more hydrogen than water? Can it be obtained in any other way than by electrolysis, i. e., taking the oxygen from the water by means of an electric current? CONSTANT READER.

364. Bleached Photographs. Is there any way of reviving bleached photographs? It seems to me I have seen a formula to this effect, but cannot recall the place.

F. SMITH.

365. Luminous Paint. I should like to be informed as to the best formula for making a good luminous paint. Can any one reply through these columns?

R. H. S.

366. Deterioration of Coal. Will some one kindly inform the readers of POPULAR SCIENCE NEWS how much coal will deteriorate by being stored outdoors more than if it were under cover where there is no rain for six months of the year? J. V.

367. Meerschaum Pipe. What is the best and quickest method of coloring a meerschaum pipe? R. G. PAINE

368. Sailing of the Buzzard. How—upon what principle—does the Buzzard (Cathartes aura) sail? He does sail, without any discoverable wing-motion, in any direction he chooses, apparently independent of any but a very strong wind, for hours at a time; rising, descending, turning, going ahead, at his pleasure, without any discernable motive power whatever.

To solve this problem, I conceive, is to take a long step in the direction of the solution of that other problem, aerial navigation. F. S. MATTESON.

369. Safety Matches. Knowing that a great many vexatious questions are satisfactorily answered through your columns, I should like to know of what material the so-called safety matches are made. There seems to be a peculiar chemical affinity between the head of the match and the material on the outside of the box; any amount of scratching on any other substance will not ignite the match, and I have often wondered as to the composition of the two materials used. Can any one tell the ingredients and the formula for mixing same? The slightest touch on the box will ignite the match, while they may be dropped on the floor or any other combustible surface without danger of their becoming ignited if stepped upon. I have never heard of an explanation or seen any literature on the subject, and believe information on this subject would be of general interest. SMOKER.

ANSWERS.

246. Heat from the Moon. The reason we get so little heat from the moon in proportion to light, is that that body is practically only a huge mirror, shining, not by its own, but by reflected light, and heat is much less readily reflected.

M. VICTOR GOODRICH.

321. Sound of Steam Pipes. I was taught in school, where we heard it at times to our great annoyance, that the harsh hammering sound, as though the pipes below were struck with a pick, was caused by the falling of drops of water formed by condensing steam through the vacuum left by condensation—an illustration of the familiar principle of the water-hammer. The remedy is obvious.

M. VICTOR GOODRICH.

330. Halo of Helvetius. I have never read a description of the halo in question, and so have little idea of what it is like. So I don't know as I ever saw it. But when I was in Coos County, Oregon, in 1874 (or 5), I saw a halo that greatly exceeded anything I have seen before or since in my 72 years of life, or that I ever heard, or read of. I will essay to describe it. (I wrote a description at the time, and drew a diagram, as best I could, for the Willamette Farmer, then being published at Salem, Oregon, by S. A. Clarke; but I failed to keep my copy, and I don't know if that description is now in existence).

In the forenoon, the sky being cloudless, there appeared in the south western sky, a large circle of rainbow, or rather two or three rainbows close together and overlapping each other. The higher segment of this circle reached nearly to the zenith, whilst the lower segment was only a short distance—about as far as the apparent movement of the moon in half an hour—above the tops of the fir trees, on the distant hills.

On the side towards the sun, and the side opposite, there appeared a portion of the segments of other similar circles, crossing at right angles, making at the crossings extremely bright "mock suns" so bright as to dazzle the eyes. But this crossing halo faded out a short distance from the main circle. At the opposite sides of the main circle were two similar crossings, but not so bright.

The exhibition continued for more than two hours. It was brilliant as the brightest of rainbows, and the most beautiful and wonderful phenomena of the kind that I ever saw. The whole town was out to see, and smoked glass was at a premium. Was this a Halo of Helvetius? If so, then I have seen it.

F. S MATTESON.

331. Animals as Weather Guides. It appears to me certainly true that "the actions of animals" may indicate, to the close observer, "the coming of pleasant or stormy weather." I could give almost numberless instances, if need be, that appear convincing to me. Suffice to say that it appears, to me, that it must needs be, that animals,—especially wild animals, and birds,—exposed to all sorts of weather, should, for their own protection, have some way of foreseeing what the weather will be; otherwise they would be caught in storms and perish. It is true that some are so caught, but I conceive that it is the old and feeble ones, or those of less intelligence. If wild animals had no instinctive way to be put on guard for storms, I conceive that the large majority of them would perish from off the earth.

F. S. MATTESON.

337. Permanent Marking Ink. The ink known as Allen Bros. Indelible Ink, manufactured by Allen Bros., No. 45 Cornhill, Boston, Mass., will be found very satisfactory. KARL S.

339. Spiders Neck and Wasp's Food. Replying to the question, Do wasps eat spiders? Yes, they do, and consider them very good eating; indeed, the mason wasps regard them as excellent food for their young, so when the mother wasp has her nest all ready, she goes out on a spider hunt. As she captures them, one by one, she stings them into a stupor, and brings them home, packs the nest full of various kinds, and lays an egg on the top, then seals the opening. When the egg hatches, it finds itself surrounded with living food, and proceeds to enjoy itself.

No, the spider has no neck B. A. L.

352. Subconscious Invention. It is not true that Edison or any one else "always solves his problems and inventions practically while asleep." His great invention of the phonograph was originated and worked out while he was awake. Of course, it is well known that problems have been solved in sleep, and undoubtedly as a result of unfinished processes of mind while awake,—the mind in sleep being free from distractions. But why call it, then, subconscious? That word is used for anything mental not attended to by consciousness, whether one is awake or asleep. In sleep with its dreams, the mind is in a state of reverie without having reverie distinguished from reality by the test of the senses. It is only exceptionally that the active powers of reason and will, needing rest in sleep, get to work while one is dormant,—the will in somnambulism, for instance. In general, our seeming reasonings and volitions in dreams are found to be absurd, on waking.

H. W. PARKER.

CURRENT NOTES.

Gelatine Engraving on Glass.

M. L. Cailletet has presented to the French Academy of Sciences a process for frosting and engraving on glass and crystal by the use of gelatine. The process consists of simply painting on a strong, hot solution of glue which is allowed to dry. As it drys it contracts and the adhesion of the glue to the surface of the glass is sufficiently strong to tear off layers of the surface, leaving a beautifully frosted design. By a mixture of six per cent. or less of potash, alum or various other crystalline chemicals, very beautiful crystalline patterns are obtained.—L'Industrie Electrique.

The Chemical Value of the Human Body.

An ingenious chemist has made the claim that the average human being is worth about $18,300 from the chemical standpoint. His calculations are based on the fact that the human body contains three pounds and thirteen ounces of calcium; and calcium, just now, is worth $300 an ounce.

High Speed Electric Railway.

The military electric railway between Berlin and Zossen has given a speed of 100 miles per hour, with a triphase current of 10,000 volts, brought down to 400 volts at the vehicle motors by the necessary transformers. The distance of 17 miles has been constantly travelled with perfect ease at the speed indicated above. The train is enormously heavy, as it carries motors weighing 13 tons and transformers weighing 6½ tons.

The Influence of Music Upon Animals.

Some very curious experiments have recently been carried out in the German Zoological Gardens in order to ascertain the actual influence of music upon animals. The instrument was the violin and Herr Baker was the performer. Of all the animals the puma was the most sensitive to the musical influence. His moods changed rapidly according to the nature of the melody, the animal frequently becoming very excited and nervous, "just like a Frenchman," as the report says.

Leopards were entirely unconcerned, but the lions appeared to be afraid, although their cubs wanted to dance when the music became livelier. The hyenas were very much terrified, but the monkeys were merely curious and interested. Wolves, on the other hand, were highly appreciative and seemed to beg for an encore.

The experiments are to be continued and with a variety of instruments, in order to distinguish between the mental states which are actually produced by the music and those which are merely the result of an unusual experience.—Sci. Am.

Adulteration of Coffees and Jellies.

Among the substances used for adulterating coffee, Schimper mentions the following: Chickory, beets, carrots, figs, various cereals, lupin seeds, acorns, carobs, dates, vegetable ivory, potatoes. Under fruit jellies, we learn that agar-agar is frequently employed for their adulteration and that this substance may be detected readily by means of the microscope, owing to the fact that the seaweeds always have numerous diatoms clinging to their surface, as any one may determine readily by burning a small quantity of agar-agar in a platinum dish, adding to the ashes a few drops of water rendered acid, and then examining under high powers of the microscope. When jellies are suspected of adulteration with agar-agar, it is recommended that the mass of jelly be boiled with about five per cent dilute sulphuric acid, and then that a few crystals of permanganate of potash be carefully added. The previously suspended diatom shells now fall to the bottom and form a more or less rich sediment, which may be examined without any further preparation.

Wireless Telephony Through the Earth.

M. Ducretet, repeating the experiments of Bourbouze made in 1876 has lately endeavored, with success, to transmit human speech through ordinary telephones, using the earth as the only conductor. The results are very interesting, though difficult to explain. One thing is certain, says the experimenter, namely that earth, filters out, so to say, the continuous current necessary to the operation of the apparatus. This current is diffused into many others capable of actuating a certain number of telephones distributed around the transmitter, and in the experiments cited these diffused currents were strong enough to operate a relay with a call-bell. These results are encouraging, and may yet, in the near future, lead to practical and satisfactory results.

BOOK NOTICES.

Practical Talk by an Astronomer. A book not for study, but for one to enjoy. By Harold Jacoby, of Columbia Univ. Pp. 224. With eight illustrations, six of which are from photographs of the heavenly bodies. Charles Scribner's Sons, New York. 1902. Mr. Jacoby has the faculty of expressing scientific facts in a manner that holds the attention of the average reader through to the end, a faculty rarely possessed by men of science. His explanation of the use of the sextant at sea is something that will be of interest to many, as also the chapter devoted to stellar photography. The perusal of the book brings before us many things that we have studied and nearly forgotten. The idea of the author was to tell his story without technicalities, so all could understand, and he has succeeded so well, that when one takes up the book for a glance, it is generally read through to the end.

The Level of Social Motion. By Michael A. Lane, pp. 577. Cloth. The Macmillan Co., 1902. The Level of Social Motion is not a technical book; it has been written not only for the scientists, but also for the great army of enlightened people who lay no claim to a technical education, yet who are scientific without knowing it. It is written in a clear, concise style that makes it easy to follow the more or less complicated lines of reasoning with which the work has to deal. All those who are interested in human society and the changes that are taking place within the body politics should read this book. It is the result of years of patient research and investigation into the causes that underlie the phenomena of social evolution.

The author claims to have discovered the law that governs the process of evolution that is hurrying us so fast towards socialism. Not the socialism that is commonly identified with anarchy, but that broad, brotherly socialism that thinking men all about us are commencing to admit must ere long supercede the present wage system, just as the wage system was the natural outgrowth of the feudal system that went before. It is demonstrated conclusively that society is hastening towards a mean number of population, which, when once reached, cannot be materially changed. It is also shown how the very forces that are making for civilization and progress will eventually re-act in such a way as to entirely eliminate the inferior races.

We are living in an age when society is awakening to a consciousness of itself, and this book is thoroughly abreast with the times. The author does not demonstrate the points of his argument with the dry bones of abstract thought, but proves them by the events that are taking place right here and now.

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Destruction of Trees by Ice.

To calculate the forces which caused such destruction, as on Feb. 21st, ult., a number of twigs were cut transversely and diagrams made of the thickness of the twig and the ice incrustation. The ice is of about the same weight as the wood of a green twig. Calculating from the relative area in cross-section, it was found that twigs one-eighth of an inch thick were carrying from thirty to forty times their weight of ice, those one-fourth of an inch thick twenty times their weight, and those one-half of an inch thick five times their weight. While the exact calculation would be rather difficult, it is safe to say that branches one-inch thick were called upon to support a weight over ten times as great as usual, and possibly twice as much. In addition to this enormous burden, the surface of the crown or branches was increased over fivefold, thus multiplying the effect of the wind by that factor. The wonder is that any limbs were left.

Forest trees depend very largely on one another for protection from such unusual conditions. Where the trees grew thick and undisturbed, the protection from the wind was so complete that much fewer and smaller branches were broken; but where man had stepped in and improved the woods, by cutting out the underbrush and saplings and leaving only the grand old trees in their majestic beauty, nature took especial pains to point out the error of his ways, and most of these grand old trees are now more fit for scarecrows than for shade. That wind and ice are not the only enemies that improving gives a chance was shown by the fact that nearly all the limbs broken off showed rot in their interior.—Forest & Irrigation.

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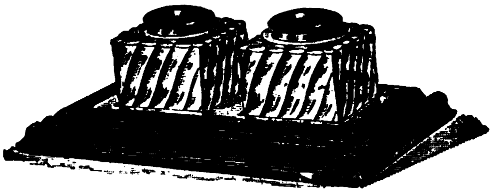

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LORD KELVIN

Whose recent visit to the United States has aroused interest among scientific circles. (See page 140)

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According to M. A. Carleton, what might be called xerophytic or drought-resistant wheats belong to several of these groups, but the most important ones belong in the durum or macaroni wheat group. This is the group, therefore, which was chiefly discussed. These wheats differ from the ordinary wheats as now known in this country by having rather large flattened heads with large chaff and very large yellowish white grains which are extremely hard and vitreous in fracture, and often rather transparent. They always have beards, which are usually very long. In some varieties the heads and beards are black. These wheats are very resistant to drought, being able to grow where the rainfall is as low as ten inches per annum. They also resist the leaf rust very greatly, but are more or less subject to stem rust when it occurs in very great abundance. They are also seldom injured by bunt, smut or other diseases. Naturally they are adapted to semi-arid or arid regions, and at present are growing mainly in east and south Russia, Algeria, Argentina, parts of India, and in various portions of the Orient and Mediterranean region. In this country they are especially adapted to our semi-arid plains from North Dakota to Texas.

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Now, take careful note of where your hat brim cuts the level surface of the ground as you look out over the latter, and from where you stand to that point will be the width of the river—a distance that may readily be measured by stepping. If you are careful in all these details you can come within a few feet of the river's width.

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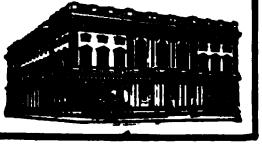

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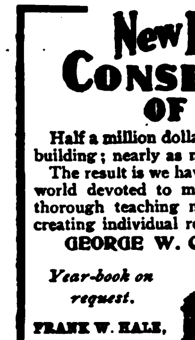

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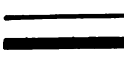

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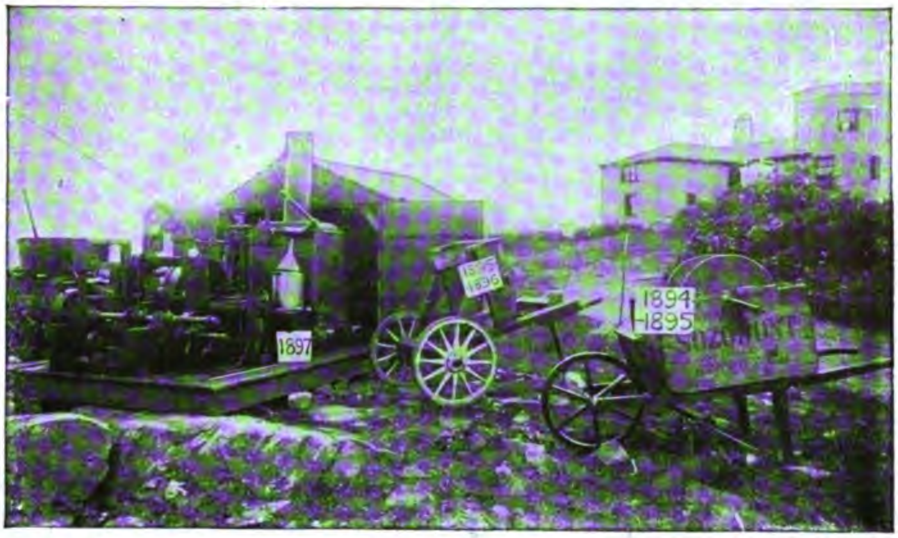

FIG. 2.—EVOLUTION OF THE KITE-REEL.

KITES AND THEIR APPLICATION TO SCIENCE

By R. I. GEARE.

MORE than a century and a half ago, kites were used as aids in securing meteorological records. In 1749, Dr. Alexander Wilson, of Glasgow, succeeded in raising thermometers into the clouds by means of kites, and, three years later, Benjamin Franklin used kites in his experiments for collecting the electricity accompanying the action of a thunderstorm. The kites used by Dr. Wilson were from four to seven feet high and were covered with paper. They were fastened one behind the other, the uppermost one sometimes going so high as to disappear among the clouds. The plan he adopted for obtaining a record of the temperature at varying heights, was to fasten to the kites thermometers, with bushy tassels of paper attached. They were dropped at stated periods, and their fall was accomplished by the gradual burning of a match-line.

About 1837, the Franklin Kite Club was organized in Philadelphia for amusement. It had among its members Espy, the meteorologist. It was he who calculated the height at which clouds should form by the cooling of the air to its dew-point, verifying his figures by means of kites. His methods are employed to-day in measuring cloud heights at Blue Hill Observatory in Massachusetts, of which Prof. A. Lawrence Rotch is the director. In 1847, Mr. W. R. Birt, of the Kew Observatory near Richmond, England, experimented with kites for obtaining measures of temperature, humidity, wind velocity, etc. He used kites of hexagonal shape attached to the ground by three strings.

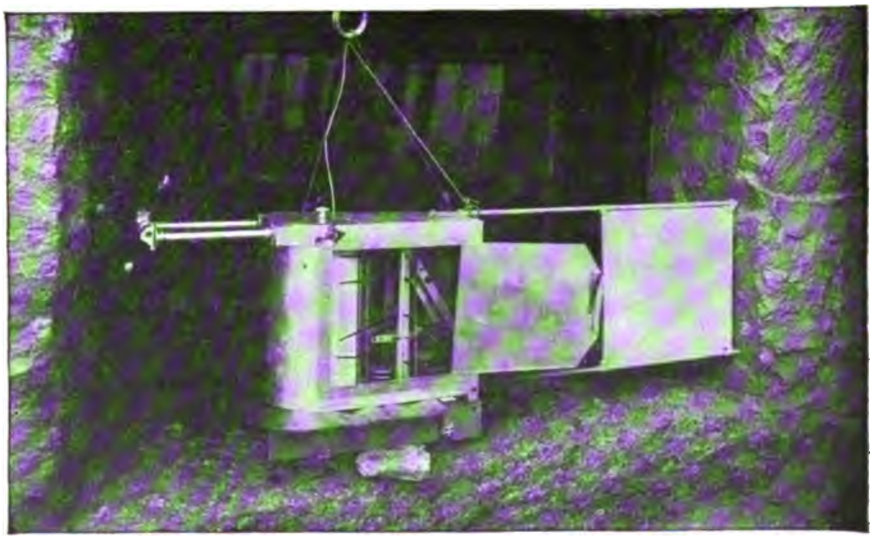

FIG. 1.—FERGUSSON'S KITE-METEOROGRAPH.

About this time there seems to have been a long lull in the use of kites for meteorological purposes, and it was 35 years later when Mr. Douglass Archibald, an Englishman, devised a comprehensive plan for exploring the air with kites, embracing practically all the features now in operation. His experiments for three years resulted in being able to ascertain the increase of wind velocity with height up to 1,200 feet. Five years of experiments enabled him to take a photograph from a kite (the first one ever taken).

This discovery was developed later in this country by William A. Eddy, of Bayonne, New Jersey.

While Mr. Archibald was at work in England, devising means for ascertaining wind velocities, Alexander McAdie, of the U. S. Weather Bureau, was experimenting with an electrometer at Blue Hill, measuring the electric potential on the level ground, at the hill-top, and several hundred feet up in the air. Mr. Eddy also discovered a method of foretelling the approach of storms, which may become of vast benefit. For an hour or more before a storm came, with a cloudless sky and only a moderate breeze blowing, he had observed his kite drawing sparks at regular intervals on a steel wire. These so increased in the frequency that they could not be counted. Mr. Eddy, who was assisted by Mr. Talbot, of London, made this statement of the occurrence:

"The steel wire left the earth at 11 A.M., supported aloft by one kite, seven feet in diameter, and the first sparks were drawn from points of tin foil, pasted on glass, attached to the wire of the reel at the earth. Mr. Talbot began to time the 'silences' of the wire, which was flashing one-second sparks like the regular ticking of a clock. With the approach of the snow squall the 'silences' were rapidly reduced to one-half a second, followed finally by a rapidity which was countless." He further states that the mysterious interruptions in the flow of the sparks were not to be accounted for by any change in the appearance of the sky, the strength of the wind, or the height of the kite. Before the storm came, the snap of the sparks, he says, "closely resembled the ticking of a Morse sounder, but it was not decipherable, the dots and dashes being difficult to record in pencil without a stop-watch."

Recent experiments have shown that electricity is usually noticed on the wire whenever the altitude of the kite exceeds 1,700 feet. It is Mr. Eddy's belief that by flying kites from vessels at sea sudden squalls can be foretold, even where the barometer's record fails to indicate their approach. Any one can see to what important results such a discovery might lead. The basis of it is traceable to the use of steel wire in place of cord for controlling kites! On account of the weight of the large cord previously in use, and the surface which it presented to the wind, it was hardly possible to reach a height of 2,000 feet. The use of piano-forte wire was therefore introduced about five years ago, shortly after which kites were flown to a height of a mile and two-thirds (8,800 feet).

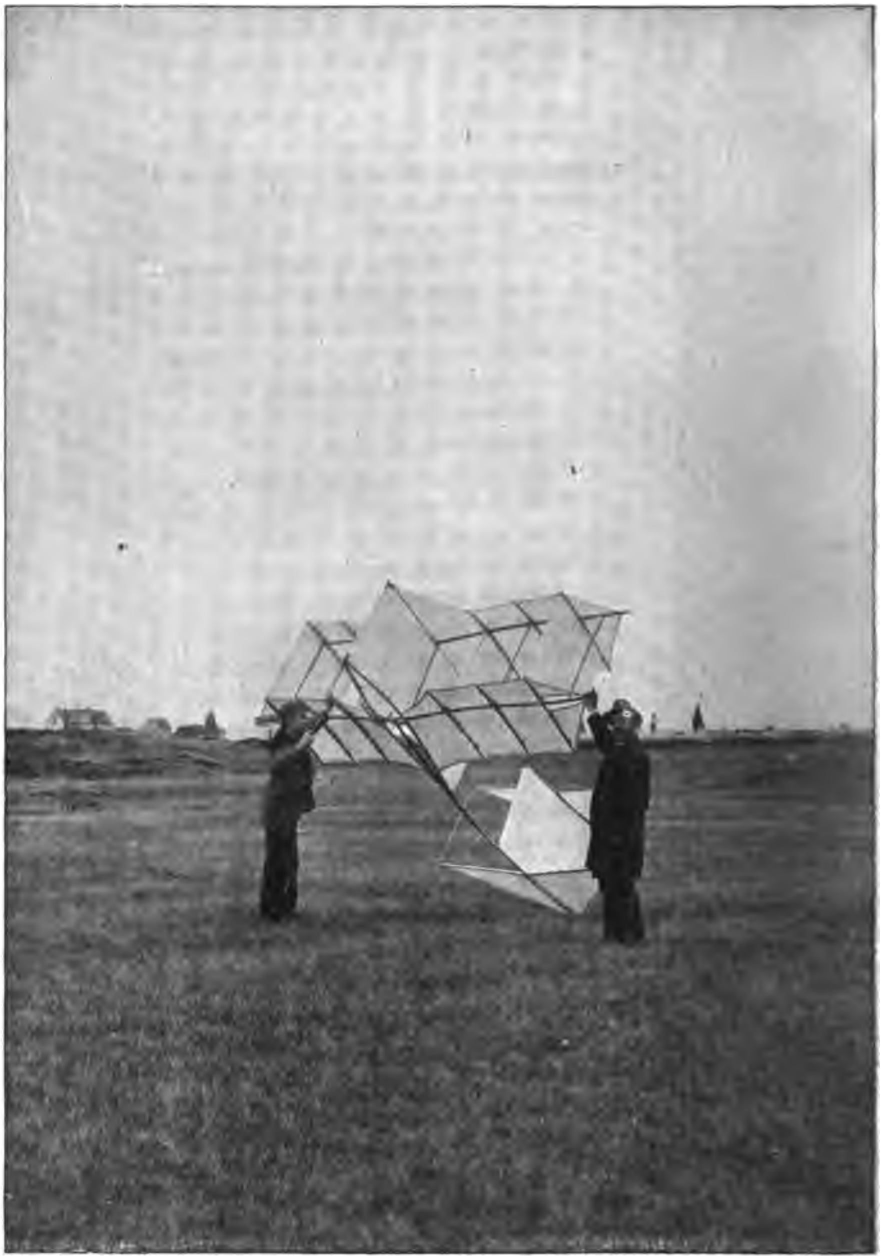

FIG 5.—LAMSON'S AREO-CURVE FOLDING KITE.

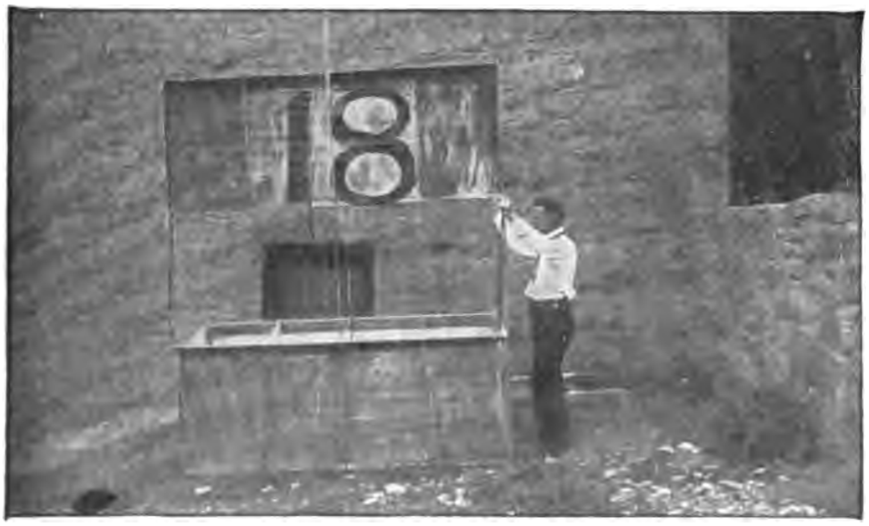

FIG. 4.—MODIFIED HARGRAVES KITE.

An ingenious apparatus known as the meteorograph, and serving as a combination of recording thermometer and barometer, was constructed by Mr. Fergusson, of Blue Hill Observatory, in 1895. Later he attached to the thermometer an anemometer for measuring the wind velocity.

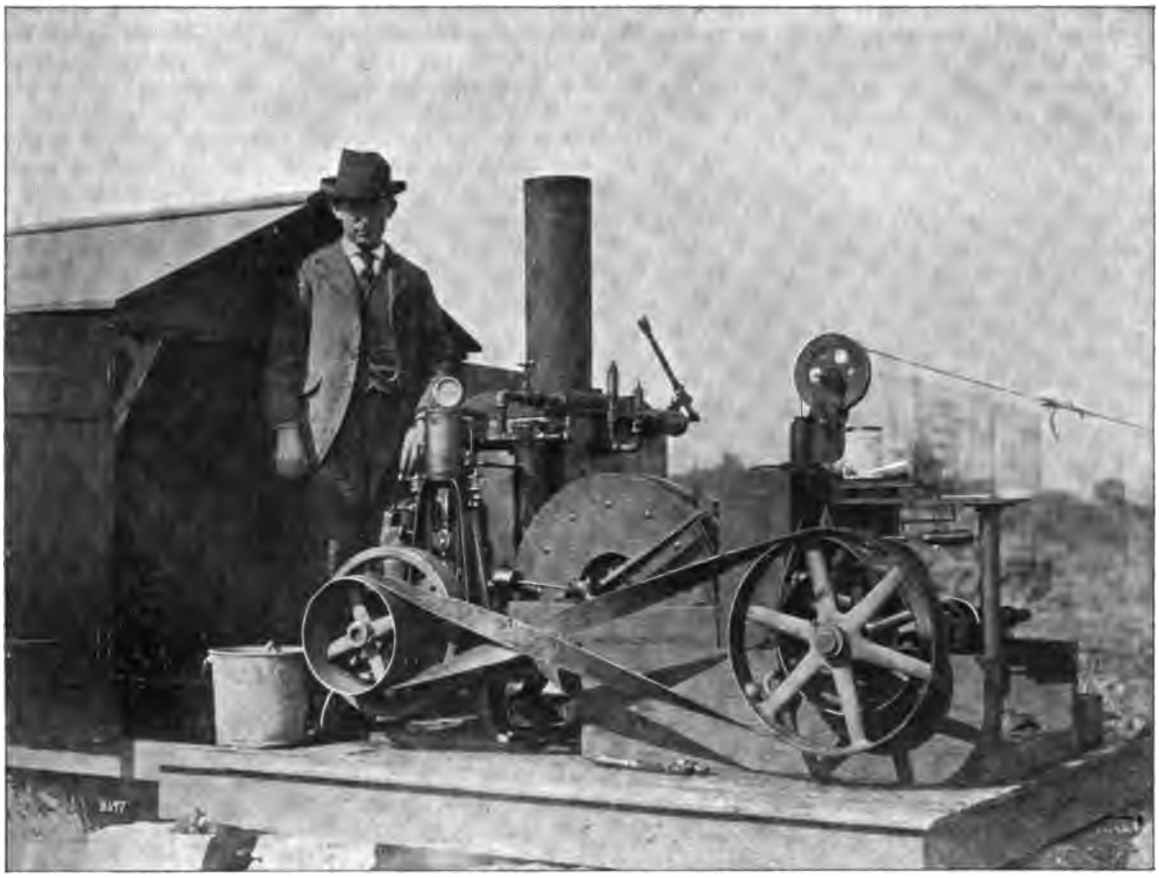

FIG. 3 —STEAM REELING APPARATUS FOR KITES.

In 1897, the Smithsonian Institution in Washington made an allotment of money from the Hodgkins fund for the purpose of obtaining meteorological records at heights above 10,000 feet. To accomplish this it was found desirable to bring steam into use for reeling and unreeling the wire. Various devices had previously been employed, as shown in the cut, but, with the use of steam, apparatus of a more elaborate character became necessary, and a winch was devised for the purpose by Mr. Fergusson. This is shown in the next illustration.

Far greater heights than 10,000 feet have since been reached by kites. On Feb. 12 1899, an automatic kite ascended 12,507 feet. This was surpassed last year, when altitudes exceeding 15,000 feet were attained. Comparing in general the meteorological results obtained by the use of kites with those recorded by instruments attached to captive balloons, the former have been found more satisfactory, owing to the stationary position of the kites as compared with the constant motion of balloons through the action of atmospheric currents. Kites, moreover, can reach higher altitudes than captive balloons, and are better fitted to withstand the greater wind velocities.

Two forms of kites now in use, which are said to be among the most efficient, are those invented by Lawrence Hargrave, of Sydney, N. S. W., and C. H. Lamson, of Portland, Maine. The former is a cellular or box kite, consisting of two light boxes without tops or bottoms, fastened some distance above each other.

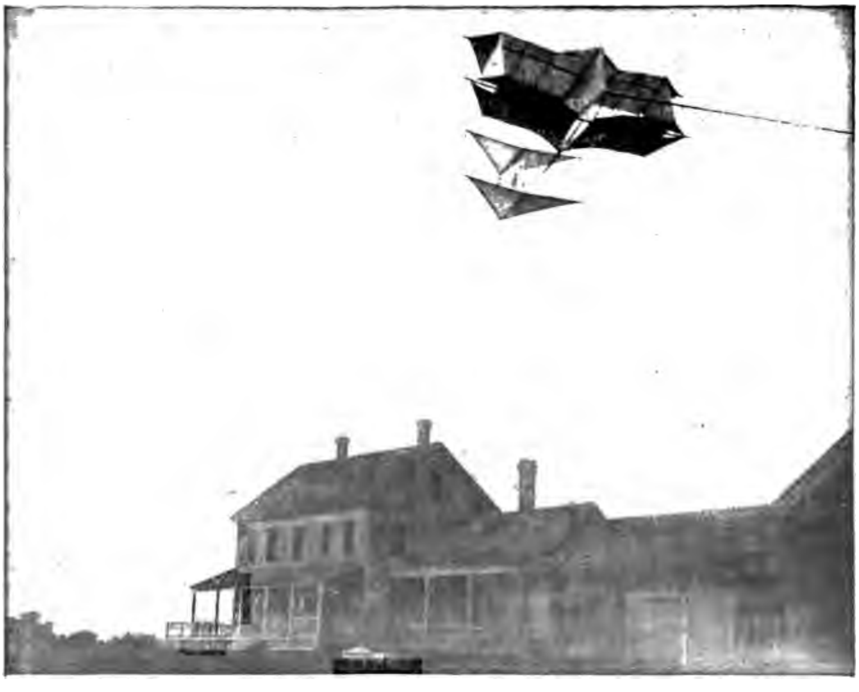

FIG. 6.—LAMSON'S AREO-CURVE KITE.

The wind exerts its lifting force chiefly upon the front and rear sides of the upper box, which inclines to the rear and so receives less pressure, preserving the balance, while the ends of the boxes, being in line with the wind, keep the kite steady. The Lamson Kite, or "aero curve" folding kite, resembles a soaring bird, and when not in use, it can be taken apart and packed away.

A detailed account of all the various kinds of meteorological experiments made up to this time with the aid of kites would hardly be of general interest, but it is hoped that the information contained in this article will be useful in attracting public notice to what is going on in this direction, and will, to a certain extent, demonstrate the probability of a much more extensive use of these quondam toys in making up weather forecasts.

The other feature, to which Mr. Eddy's recent experiment has called attention, namely, the ability to draw electricity out of the air, is of special concern at this time, when electricity is coming into such rapid and general use, and it may be only a question of time when the present cumbrous machinery for generating the electric fluid will give way to a more simple process, i. e., of gathering it at pleasure direct from nature's storehouse by means of steel wires attached to kites.

[The facts presented in this article are largely compiled from reports made by Prof. Rotch, and the illustrations are reproduced with his kind consent].

Cycles in Scientific Thought.

It is most instructive to see how neatly the modern hypothesis may be twisted into a ludicrously complete confirmation of the venerable theories of Æpinus. It is a metaphysical doctrine sometimes set forth that thought swings in great slow cycles, the learning of one becoming the ignorance of a second, and the brilliant speculation of a third. Lucretius advanced much of the modern atomic theory hard upon two thousand years ago, and Omar Khayyam proposed a calendar even simpler than the one now current. The one-fluid theory has spanned fewer centuries than these, but it has been more fortunate in its champions. And so the cycles recur. There is already evidence of the recrudescence of the emission theory of light, and it would not in the least surprise us to see within the next year or two the whole wave hypothesis openly attacked.

The late Prof. Rowland used often to exclaim: "Who will be the Kepler of the molecule?" We do not know, but we feel reasonably certain that he has not yet appeared. We are far from desiring to cross swords with so doughty a leader as Lord Kelvin, but we earnestly wish that the next man who invokes an electrically charged atom electron or electrion to explain physical phenomena, would kindly preface his hypothesis with a definite and consistent explanation of what he connotes by the expression "electric charge." If half the energy had been spent in the last few years in investigating the dynamics of electrical stresses that has been put upon hypothesis derived from them, we would know more about the constitution of matter. At the present the electron needs explanation just as badly as the atom or the molecule.—Elect. World and Engineer.

SCHOOLROOM TEMPERATURE AND HUMIDITY.

BY WILLIAM GEORGE BRUCE.

If we contend that the march of human progress finds its inception and stimulus in the schoolroom, it is only reasonable to hold that the schoolroom should share in the trophies acquired by the intellectual warrior in the field of science, art and letters. The schoolhouse, in accordance with its own necessities, is entitled to all that human thought has achieved. In order that it may continue to fulfill its mission to the highest degree, the schoolhouse can make a just claim to the best devices invented by man.

We have reached a period where the schoolhouse has become more than a mere gathering center or a shelter against the elements. We have come to recognize that its very walls are a factor in the educational growth of the child. The structure no longer merely houses the children, but it has become a huge educational device as well. It adapts its appointments in order that they may bear the largest educative influence upon the inmates and also protect their physical welfare as a prerequisite to intellectual advancement.

Until a few years ago, the essentials of a schoolhouse were few. To-day we discriminate between a variety of systems of heating devised by able engineers. Ventilation has been reduced to an exact science. Schoolroom lighting is thoroughly understood and correctly applied.

In drawing comparisons between the old and the new schoolhouse, some school-board members are apt to lapse into the belief that the crude structure of former days, with its meagre equipment, would suffice to-day. Others will reason that too much goes into the modern schoolhouse.

One might as well argue that the wooden plowshare of ancient times will serve as well as the steel plow of to-day, or that a tallow candle will shed as much radiance as an electric light. The boy of to-day requires a better mental equipment for the battle of life than did our forefathers. The general progress in all lines of human activity will make greater demands upon the young man of the future. Thus, not only the modern school, with its well-devised courses of study and educational methods, but the whole schoolhouse, are the result of advanced conditions.

In approaching my subject I must first of all correct an erroneous impression, which exists in minds of a portion of the school public. One of the peculiar features which has developed in my inquiry on temperature regulation in schoolhouses is the tendency to confound it with another subject.

It would seem unnecessary to explain that heat regulation pertains entirely to a system by which the temperature is controlled against excessive heat or excessive cold. It would seem equally unnecessary to explain specifically that ventilation pertains to the introduction of fresh air and the removal of foul air.

While every one knows this, we find many school officials who do not differentiate temperature regulation from ventilation. No doubt if asked point blank to define the difference between temperature regulation and ventilation, a correct answer would be received in each instance. It is not ignorance but thoughtlessness that causes the misconception.

It is one thing to provide a classroom constantly with fresh air; it is an entirely different thing to so regulate that the air is neither too warm nor too cold. Thus, let us bear in mind the wide difference between ventilation and temperature regulation.

A discussion of the subject of temperature regulation can only result in beneficial results. If school officials have hitherto occupied their minds with the various kinds of heating systems to the exclusion of temperature regulation, it is because the latter has not been urged upon them with any considerable pressure. A busy set of men—busy in their several vocations in life—does not always find it convenient to give the time necessary for a thorough study of all the things that ought to go in or about a schoolhouse.

In the modern schoolhouse artificial heat need no longer be measured out extravagantly or penuriously to the discomfort or danger of its inmates. It can be placed under automatic control by simple devices—insuring economy and protecting the health of the inmates.

In attempting to say something about temperature regulation, as applied to schoolhouses, I may be pardoned if I assume that a scientific discussion is neither in place nor desirable. Hence, I will treat the subject in an elementary form.

An even temperature at a certain degree is conducive to the growth of plant and animal life. Vegetable and animal foods owe their prolonged preservation to an even temperature.

An apple picked in October of last year and found in fine flavor and juice in the month of June this year, owes its wonderful preservation to nothing else but an even temperature. The qualities of the apple have been prolonged by the control of natural elements. In the same manner has the growth of the strawberry, which reaches the market in the month of January, been hastened by surrounding it with a temperate atmosphere. Temperature extremes hasten the death of both plant and animal life.

It may be claimed that a variation of temperature is conducive to hardihood. Under certain conditions, yes. A child may withstand extreme cold while engaged in healthful exercise. Under certain conditions extreme heat may be borne without injurious effects. When the body, however, is inactive, a variable temperature is harmful. Thus, an over-heated as well as an under-heated schoolroom may do incalculable injury to the child.

The automatic control of schoolroom temperature involves primarily the question of finance. The great majority of school houses in the United States require artificial heating during seven months in the year. The fuel expense in cities and towns where large buildings must constantly be kept warm, is a heavy one. The consumption of fuel is steady and constant during certain periods of the year—continuing year after year. Thus any slight daily reduction in fuel consumption may prove a considerable saving at the end of a month or a year. The saving of a few hundred dollars in the purchase of a school site or the erection of a school building offers no comparison with the aggregate saving accomplished in a daily reduction of the fuel expense. Every degree of excess heat represents that much waste.

Temperature regulation in the schoolroom, however, is a simple proposition. It requires no expert mathematician to measure its material advantage, nor a medical expert to determine its hygienic qualities. A few things need only be considered. If the outdoor temperature is 50 degrees, and the school temperature should be 70 degrees, only 20 degrees of artificial heat is required to make the schoolroom comfortable. Consequently the fuel expenditure should cover 20 degrees only. That which goes above this is waste and consequently extravagance. An open window to cool off an over-heated room is an unwarranted exposure of the school occupants to coughs and colds which may lead to serious results. No school board has the right to endanger the physical comfort and welfare of either pupil or teacher.

But let us get back to the expense item again. The fuel expenditure should cover only the difference between the outdoor and indoor temperature. This may vary all the way from zero up. Variation may be constant. The most attentive janitor will miss his firing by several degrees of the temperature desired or required. In the forenoon the outdoor temperature may be 40 degrees; in the afternoon 50 degrees. Consequently 30 degrees of artificial heat are required in the forenoon, and only 20 degrees in the afternoon. The janitor may anticipate the change in temperature. The chances are that he does not. The surplus heat has either escaped through the chimney with the janitor's aid, or through the schoolroom window with the teacher's aid. A well-adjusted mechanical device would regulate the temperature from minute to minute without human aid, and regulate the fuel consumption accordingly. Even a few degrees of excess heat will make a vast difference in the aggregate of fuel consumption for the year. This stands to reason. Therefore an accurate adjustment of fuel consumption must effect a saving in the fuel expense.

The physical welfare of the teacher and pupil cannot be treated as a secondary consideration. In fact, if it is admitted at all that hygiene is a factor in schoolroom temperature, it follows that it is one that must precede monetary considerations. Therefore, if it will effect an actual saving in dollars and cents, sufficient to pay its installment in a few years, the advantage is a double one. Were this not the case, the hygienic proposition involved would alone be sufficient to warrant a recognition of the advantage derived from a heat-regulating device.

It is not my purpose here to champion any one system of automatic temperature regulation. There are several systems on the market, some of which are all that could be expected of them, while others are worthless.

The subject of atmospheric humidity or air moisture and its relation to the human system has thus far received little or no attention at the hands of school authorities. While the subject is an important one, but little data has been collected. The scientists, who have entered this field of investigation, contend, however, that for certain classes of invalids the prevailing humidity at a given point is of more consequence than the variability of the temperature, no matter how sudden or sharp the variation may be. Yet, it is held that medical literature is almost entirely lacking in a scientific explanation of the effect of the different degrees of humidity upon the animal economy.

Dr. W. M. Wilson, director of the United States Weather Bureau, who has given the subject careful study says: "It is safe to assume that during the winter months the normal relative humidity in lake cities is 72 per cent., and the average diurnal range is from 60 to 72 per cent. From observations with respect to moisture in business offices and living rooms heated by steam, hot water and hot air, it is safe to assume that the average relative humidity in artificially heated dwellings and offices in the winter months is about 30 per cent. or about 42 per cent. less than the average humidity, and drier than the driest climate known.

The evaporation power of the air at a relative humidity of 30 per cent. is very great, and when the tissues and delicate membranes of the respiratory tract are subjected to the drying process, a corresponding increase of work is placed upon the mucous glands in order to keep the membranes in proper physiological condition. Nature in her effort to compensate for the lack of moisture in the air is obliged to increase the functional activity and the frequent unnatural stimulation, induced by the changing conditions of humidity from the moisture-laden air outside to the arid atmosphere inside our dwellings, finally results in an enlargement of the gland tissues, on the same principle that constant exercise increases the size of any part of the animal organism. Not only do the glands become enlarged, but the membrane, itself, becomes thickened and harsh, and, sooner or later, the surface is prepared for the reception of the germs of diseases, which tend to develop under exposure to the constantly changing percentage of humidity.

The medical authorities tell us that the "physiological symptoms of an atmosphere too dry are parched lips and tongue, a dry feverish condition of the skin, and, in those children, predestined to lung diseases, a hacking cough, resulting from the desiccating effect of excessively dry air on the lungs and bronchial tubes."

A mummified and shrivelled appearance of the human skin is caused by a dry atmosphere. The ruddy complexion and red cheeks of English men and women is due to air moisture. The importance of aqueous vapor as a constituent in our atmosphere was not exaggerated by Tyndall, when he startled the scientific world by the announcement that "the removal, for a single summer night, of the aqueous vapor from the atmosphere, which covers England, would be attended by the destruction of every plant which a freezing temperature could kill."

On the economy of fuel consumption achieved by controlling humidity in the schoolroom I can do no better than quote Director Wilson again. He says:

"A humid atmosphere is economical. In a room in which the temperature is 72 degrees," said he "the temperature of the wet-bulb is 54.5 degrees. If a room with a sensible temperature of 54.5 degrees is considered comfortable, the same result can be attained by heating to only 60 degrees, and supplying sufficient moisture to raise the humidity to 70 per cent., which still conforms very closely to the normal condition of the outside air, so far as moisture is concerned. It would probably be impracticable to maintain uniformly a relative humidity of 70 per cent., especially with a low outside temperature, as the condensation upon the windows would be undesirable; but by heating to 65 degrees the relative humidity could be held at 50 per cent. without any ill effects, except possibly on extremely cold days. Competent engineers estimate that about 25 per cent. of the cost of heating could be saved by holding the temperature at 60 degrees and raising the humidity to 70 per cent., still maintaining a wet-bulb temperature of 54.5 degrees, the same as that obtained by heating to 72 degrees under ordinary conditions. But to be conservative and avoid the possibility of any unpleasant results from condensation, our dwellings could be heated to 65 degrees with a relative humidity of 50 per cent., and still save from 12½ to 15 per cent. over the present cost."

Here, perhaps, it ought to be explained why humidity will permit a lowering of the temperature without discomfort to the body. With a dry atmosphere the evaporation of the body is stronger than it is in a humid atmosphere. Consequently, we feel cooler in a dry than in a moist atmosphere of the same temperature.

The question, which would naturally arise in a discussion of this subject would be whether humidity can be brought under mechanical control. Or rather, can atmospheric moisture be supplied artificially to the extent that it may be desired? The need of a larger quantity of moisture in schoolhouses heated by artificial means is recognized, but the difficulties encountered in solving the problem have, it is claimed, largely deterred practical research in this direction.

But here the triumph of the scientist must again be recorded. Recognizing that a humidifier is as necessary to a first-class heating plant as is a temperature regulator—the inventive mind has also brought atmospheric moisture within automatic control and regulation.

Thus, without going over the entire range of modern construction and maintenance of schoolhouses, it may reasonably be assumed that the same energy and study, which has brought about wondrous changes in other branches, has also been directed towards perfecting the schoolhouse, making it modern in all that the word implies. It remains for the authorities, who govern the practical affairs of the American schools of the present day, to avail themselves of the achievements of the human mind.

If education is the mainspring of progress, the schoolroom is an elementary workshop. It ought to be a reflex of that progress in all its own appointments. If the schoolroom implants the seeds for useful human activity, its own environments ought, in keeping with its demands, to enjoy the blessings of that activity.

[Address delivered before the Department of School Administration, N. E. A., Detroit, June 10, 1901.]

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Some School Statistics.

The figures given in World's Work have an interest as showing the value put on education in some states.

The average value of schoolhouses and equipment in North Carolina is $180; in South Carolina, $178; in Georgia, $523, and in Alabama, $212. The average salary of a teacher in North Carolina is $23.36; in South Carolina, $23.20; in Georgia, $27, and in Alabama, $27.50. The average number of days' school taught is—in North Carolina, 70 in the year; in South Carolina, 88; in Georgia, 112, and in Alabama, 78. The average expenditure per pupil in average attendance is—in North Carolina, $4 34; in South Carolina, $4.44; in Georgia, $6.64, and in Alabama, $3.10 per annum. In other words, in these states in schoolhouses costing an average of $276 each, under teachers receiving an average salary of $25 a month, we are giving the children in actual attendance five cents' worth of education a day for only eighty-seven days in the year.

Animal Life

THE CAT AGAIN.

BY HELEN E. MILLER.

Is it because the cat has come down to us through countless ages, wrapped in the mantle of the dark superstitious awe and ignorance of many centuries, that even among intelligent, well-read and practical people of the present time, we find those who cannot wholly free their minds from the misty uncertainties which seem to surround it? If not, we must look elsewhere for the cause of the universal ignorance regarding the cat, for that such lack of knowledge does exist, is more obvious than might at first appear. Despite all that has been written by Prof. Wilder, H. Weir, Mrs. Winslow, and others, the cat is the least known and understood of all our domestic animals, and yet is closer to man in the similarity of its habits than any other household creature, not excepting the dog.

I could cite numerous instances to substantiate the truth of the above statement, examples ludicrous, pathetic, disturbing. Brave men who have shrunk from touching a sick cat; women who have kept their pets in confinement because an overflow of spirits, not understood by them, have led them to think that the cat was going mad; others who have not comprehended their cries of distress, but have left them to suffer; for this reluctance to touch or administer to a sick cat, is a curious human trait, not exhibited towards other animals. Having studied the cat for many years, I feel I am to some extent justified in making a few remarks on their habits, information gleaned entirely from my own experience with them.

Some of the common beliefs which appear to be current, but which I have found to be fallacious, are that cats object to water, that they catch their prey by scent, and that a cat should have all the milk it can drink. Now, in reality a cat no more objects to water than any other animal not endowed with a propensity for swimming; and while it has never been known to bathe or cool itself in this way, it by no means objects to walking out in the rain, or coming home drenched in dew, from its early morning forage through the long, wet grass.

One of the most ludicrous scenes I ever witnessed was that of a kitten playing with its reflection in a puddle of water. It would first pat the water with its paw two or three times, then, arching its back and drawing all four feet in a bunch, leap high in the air and come down with a tremendous splash in the middle of the puddle, and then with a twist, be off down the road in a flash, only to return in a few moments and repeat the performance.

I have seen cats, too, roll over and over in the snow, enjoying it most thoroughly. Again they invariably choose ditches or the banks of small streams for their hunting grounds, and the story that the ancient Egyptians used cats in the hunting of small water birds, is not as incredible as it might at first appear to those who have been accompanied on their rambles by their cats, and noted how, untrained though they are, they will work almost as well as a trained setter.

Cats do not catch their prey by scent, but wholly by their marvelous sensitiveness to the slightest motion, yet they have the full power of scent. I have frequently tested this with four or five cats sleeping under the stove; without noise of any kind, such as using a knife or saw, I will bring some raw meat into the room. In less than a minute, every cat will be on its feet, clamoring for some of it; but if I bring in a mouse and place it near the cat's nose, it will not awaken, but may perhaps open one sleepy eye, look at it, and settle off for another doze. I have laid the mouse across the cat's nose before I could make it realize what it was. I have placed a dead one among several cats, and they have apparently taken no notice of it until I have given it a slight movement by means of a string tied to the tail. Then every eye would be dilated, every muscle quivering with excitement, and quicker than a flash of lightning, the most nimble would be upon it.

Cats are peculiarly human in their ailments, and can catch from and impart diseases to their human friends. The first case of real grippe known in our village, was brought there by my cat. I nursed her through a very severe attack, only to fall a victim to it myself. She was of a roving disposition and had probably caught it in some neighboring suburb. Colds, diphtheria, nausea and fevers, are all common to the cat, and should be treated as we treat them for ourselves. Those who take a freshly weaned kitten to raise, should bear in mind that bread soaked in a little fresh milk, and not much milk or bread, is the very best food either a kitten or cat can have; and that sour milk in the summer will as surely make your kitten ill, as it would your year old baby. Scalded milk is better than the cold fresh milk. Cats need very little meat, just a few scraps now and then; their own efforts, as mouse catchers, should supply them with all they need—too much meat being a sure cause of fits. For 25 years I have twice daily given my cats the above diet, and during that time not one has had a fit of any kind. They have not only been noted as good mousers, but rat-catchers as well, which is not so usual, the rat not being the legitimate prey of the cat; indeed, when they do catch them, they very rarely eat them.

Cats have quite an extensive vocabulary, and had I space, could mention at least six different vocal sounds made by them. They seem to have one especially for their owners, which I have never heard them use to each other, though they will frequently use their own peculiar language in addressing their masters. These sounds are easily understood and interpreted. I would say, in conclusion, that the above remarks, as will be seen, refer to the common everyday cat, as I have had no experience with the more delicately-bred cat aristocracy.

Mosquitoes in Italy.

There is a special aniline dye which when diluted even to the extent of 0.00031 per mil., is said to kill the larvæ. The well-known pastilles and powder, similar to ordinary insect powder, which can either be burnt or distributed by means of bellows, are also mentioned. This powder is made of the flowers of the Pyrethrum roseum, a herb extensively grown on the Dalmatian coast, the cultivation of which is being tried near Ceprano, a town about half way between Naples and Rome. It is found that valerian root, powdered and mixed with the other, renders it more efficacious.

Experiments were made during last summer by Prof. Grassi to combat the malaria by the use of drugs. Having selected one of the most malarious places in Italy, Ostia, at the mouth of the Tiber, Prof. Grassi and his staff have administered six pills a day to adults, and a proportionate dose to children, the pills being composed of a compound called 'esanofele,' a harmless drug composed of quinine, arsenic, iron and bitter herbs. Dr. Grassi speaks highly of the results, and the tabulated statistics of the Ostia treatment appear very favorable.

How a Butterfly Sleeps.

A writer in the Spectator says that the butterfly invariably goes to sleep head downwards, its eyes looking straight down the stem of the grass. It folds and contracts its wings to the utmost, partly perhaps to wrap the body from the cold. But the effect is to reduce its size and shape to a narrow ridge, making an acute angle with the grass stem, hardly distinguishable in shape and color from the seed-heads on thousands of other stems around. The butterfly also sleeps on the top of the stem, which increases its likeness to the natural finial of the grass. In the morning when the sunbeams warm them, all these grey-pied sleepers on the herb tops open their wings, and the colorless bennets (Geumurbanum), are starred with a thousand living flowers.

New Gas Mantle.

In reference to gaslight mantles, it is reported that an Austrian engineer has discovered and perfected a chemical compound which, when added to the thoria-cera mantle, converts it from a loose, fragile structure into an elastic glass, where the chemical constituents are chemically combined, and not merely mechanically held together.

AN INDIAN ARROW POINT.

BY CHARLES EMMETT BARNES.

In all nature study and specimen hunting there is nothing that produces such strange feelings, such a fascination, as the finding of an Indian arrow point. To pick up a flint point that you know has lain undisturbed in the ground for perhaps a hundred years, and to realize that yours is the first hand that has touched it since it left the bow of the Indian a century ago, creates a weird, uncanny sensation. It is unlike the finding of other specimens, because there is associated with it human interest. As you hold the point in your hand, it brings forth a supernatural feeling.

The more you look at it and reflect upon its unknown and mystical history, the more you are influenced. Your thoughts intensify. You meditate. What of its history? Who made it? Where was the flint obtained? Was it aimed, when last shot, at game or an enemy? In either case it missed its mark, or the Indian would have recovered it. If at an enemy, did the latter take advantage of the miss and kill his antagonist? If its history could only be known, what an interesting story or a tragedy it might tell of the long ago when the savage alone possessed the forest and held undisputed sway. And so a train of thought is started, as one gazes upon it, that has no ending.

The arrow point tells a marvelous story of the evolution of the races of mankind. Potentially in that arrow point is the beginning of all arts, mechanics and sciences of to-day. The first faint ray of intelligence in the first savage that conceived the idea of fashioning an arrow point out of the hard flint rock to assist him in obtaining his food and to afford him an advantage in warfare, was the starting point that culminated in the mechanical knowledge of this wonderful age. Who was this first savage? How and from whence came this first mere ray of intelligence? There was certainly a first one who possessed an immature thought; a crude idea. What awakened that dull brain? How did he come to select the very best material that could be chosen; the very best adapted to the purpose—flint? How did he conceive the practical shape of the weapon?

From that stupid, half animal brain of æons ago, has slowly, slowly, oh, so slowly, evolved through the centuries the intelligence that produced in the after ages the great discoveries and inventions. Through and from that primeval idea has evolved the steamboat, steam engine, the railway, the telegraph, electrical inventions, all tools and machinery, and the mechanics and discoveries that crown this century.

Is it any wonder that the arrow point possesses a fascination for the archæologist and the collectors of specimens, when potentially involved in it is the heredity of our time, the civilization of this age?

To Clean Oil Paintings.

Take the picture out of the frame, have near you a bottle containing spirits of wine 56°, add one-fourth part of spirits of turpentine to it, and another bottle containing spirits of turpentine. Lay the picture flat before you, moisten a piece of cotton wool with the spirits of wine, commence to clean the painting by lightly running it in a circular motion with the tuft of cotton, keep changing the cotton and moistening it with the spirits of wine, examining the cotton to see that none of the color is being removed. Then take a clean rubber of cotton and moisten it with spirits of turpentine, and rub gently over the picture in a circular direction. Great care is required in cleaning with the spirits of wine not to dislodge the color, which will be seen on examining the rubber if it has the slightest appearance of other than varnish, which is usually of a faint yellow tint.

Luminous Photographs.

How to produce a luminous photograph is described in the Photographische Rund. It is done by means of calcium sulphide, otherwise luminous paint. A sheet of transparent celluloid is coated with an emulsion of nine parts of gelatine, one of potassium bichromate, five of calcium sulphide, and one hundred of water. The gelatine is soaked in the water, and melted in a water bath, the other ingredients being added afterwards. When the coated film is thoroughly dry it may be printed upon from a positive through the celluloid film. This precaution is necessary to prevent the image washing off during development, which is done by hot water, as in the case of a carbon positive. Backed up by black velvet or paper, the print will appear as an ordinary black-and-white positive by daylight, to which it should be freely exposed, and will be self-luminous in the dark.

Metals from Natural Solutions.

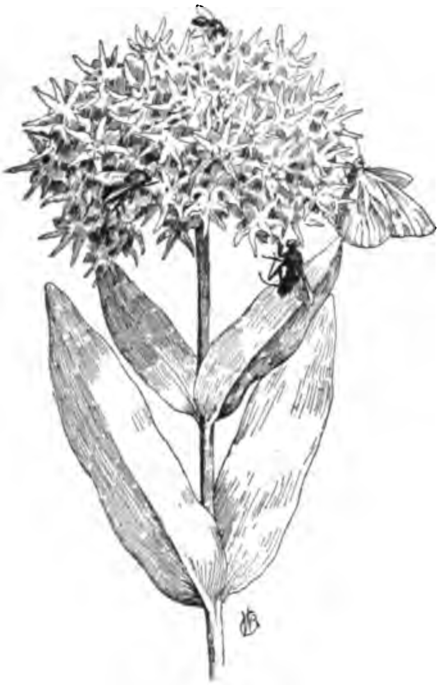
The work of Liversidge on the crystalline structure of metallic nuggets has already been noticed in the periodicals. This work has been continued by the examination of a number of new specimens. The structure is studied by etching a polished surface of the metal. In nuggets from Lake Superior containing both silver and copper, it appears that the silver has been deposited upon the copper. Gold nuggets from the Klondyke present a structure and appearance quite different from those of any other locality. They are very pale in color, owing to the large quantity of silver present. An assay of two specimens gave only sixty-five per cent. of gold. In the case of silver and copper nuggets, as has been found with those of gold and platinum, there is every indication that the metal has been deposited from solution, and there is nothing to indicate that the nuggets have undergone either igneous or hydrothermal fusion.—Science.

Plant Life

INSECT-CATCHING PLANTS.

BY G. WESLEY BROWNING.

Much has been written concerning such curious insectivorous plants as the Venus fly-trap, the pitcher plants and sun-dews, and the great Darwin has contributed to science a good-sized volume on this subject alone; but we may find many other plants that catch insects, but which are not insectivorous, and these have not been of so frequent comment. No doubt there are several species of flowers in nearly any district, which, although having no apparatus for digesting animal matter, are nevertheless as surely adapted to ensnare insects as the most artfully constructed spider web, but in many such instances it is evident that the catching of insects is an accidental circumstance, and the means of such accomplishment not designed by Dame Nature to that end.

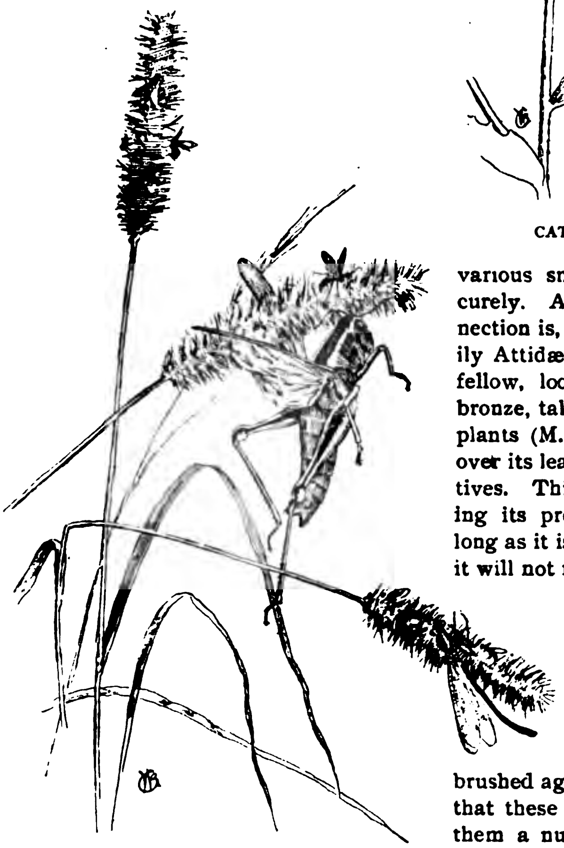


MILKWEED AND ITS VICTIMS.

I believe it is pretty well known that the milkweed flowers are very effective traps for small insects. On examining specimens of a silver-spot butterfly (Argynnis), I have sometimes found a pair of club-shaped appendages adhering to their feet,—in one instance, all four extremities being so decorated. When I say all four, it will be remembered that Argynnids, in common with many other butterflies, do not use their first pair of legs as organs of locomotion, or prehension, these being so modified to other use as to bear but little resemblance to the other legs.

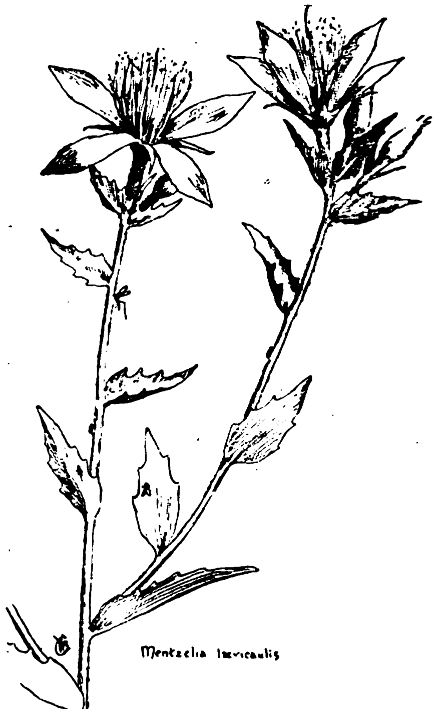
Recalling that most of these specimens were captured about milkweeds, I visited their locality again, and found (a condition overlooked in my previous chase of the fascinating silver-spots) that the flowers held in durance vile a large number of flies and some other small insects, among which was a cabbage butterfly unable to extract its proboscis from the blossom from which it had been sipping. The Argynnids, being larger and much stronger than this luckless visitor, were able to pull away from the milkweeds, but carrying the club-shaped pollen masses with them. And so, we see here that Nature had not intended the creation of an insect snare, but primarily a means of pollenizing flowers through the medium of their insect consorts, the captives being among the incidental victims of misfortune that frequently figure as giving up their lives to no evident purpose in the carrying out of Nature's grander schemes.

No doubt any one who has given much attention to the plants of his or her locality, will have become familiar with one or more species of the genus Silene, commonly called catch fly or campion, the stems of which have a part of each internode covered with a viscid substance to which we generally find adhering various small beetles, flies, aphides, and, occasionally, even Agrionine dragon flies. It is somewhat puzzling to attempt to determine just what purpose this provision serves the plant, unless, as is suggested by the way we sometimes daub a ring of pitch or other sticky matter about the trunks of our fruit trees, it may be effective in keeping certain insects from climbing up the stems to feed on the flowers.



THE HAPLESS TWO STRIPE.

Throughout the more arid portions of Utah and the adjoining states, we find several species of Mentzelia. Some of these have large and beautiful yellow or whitish flowers, and there are two kinds at least which, like the evening primroses, open only towards evening; closing again as the morning sun strikes them, while with other species, the reverse is true. These plants are clothed with a fine barbed pubescence that takes hold of the feet of various small insects, holding them securely. An interesting fact in this connection is, that a small spider of the family Attidæ, a handsome and active little fellow, looking like a fleck of shining bronze, takes up its abode on one of these plants (M. lævicaulis), and ambles freely over its leaves and stems looking for captives. This spider spins no web for catching its prey, and it is evident that—so long as it is the protégé of the Mentzelia, it will not require such a web.



CATCHING FEET OF INSECTS.

Among the weeds of my garden one year, were profusely dispersed clumps of fox tail grass, having a bristly inflorescence that immediately attracted attention by adhering to one's clothing wherever brushed against. Further notice disclosed that these grasses usually had sticking to them a number of "lady bugs" (Coccinnellidæ), lace-wings (Chrysopa), and other small creatures of similar kinds. An amusing incident occurred one morning as I walked among these grasses: There were plenty of grasshoppers that year, and they were continually springing up from the path in front of me. Suddenly one of them, a large female two-stripe locust, that had not directed her heavy flight correctly, sprang against an overbanging spike of foxtail. Instantly her gauzy underwings were grasped by the little barbed bristles, and she was abruptly arrested in mid-air. Her weight was sufficient to bend the grass stalk low enough to allow her to get an occasional footing against a spray of weeds, and she continued to vibrate up and down like a child playing see-saw, until her struggles detached enough of the bristles to release her, but her wings were a sad wreck.

These few observations all being made in one locality, I have no doubt that many other places would afford numerous and more curious examples of an analogous nature.

Pasture Weeds, Prevention, Eradication.

There is a constant demand nowadays for information concerning measures for keeping weeds out of grazing lands. Weeds are generally plants that have become adapted to living in many climates, on many soils and under very various conditions. Some of them are truly cosmopolitan, being found in almost all countries. Their transportation to other countries is usually due to man, a very common means of distribution being through accidental mixture with grain, vegetable or grass seeds. Railroads, particularly through the freight trains, carry seeds of weed plants from place to place. In such ways weeds suddenly come to appear in new and unexpected regions.

The dominant vegetation existing in any section of the country, if left to itself, usually repels invaders. In an old plant region, as a forest or a prairie, vegetation of a particular sort has established itself as the result of centuries of competition with other plants contesting for the same space. Seeds of invading species, however, may lie dormant for some time in the soil, awaiting the clearing of the land to germinate and grow. Notice the new plants that appear where land is cleared of trees or sod and left to itself. The most common cause of weed invasion of native pastures is overpasturing, whereby the wild grasses are kept down so that they cannot compete with the weeds.

Eradication of weeds already present in pastures depends on the particular case. Annual weeds can be killed out by mowing before seeding. This may have to be repeated several times during the growing season as many of them will send up new sprouts. In the case of biennials or perennials with tap roots, cutting the latter under ground and beneath the "crown" is effective. Perennials like the bind weed, which spread by underground stems, are extremely difficult to deal with, because every bud on such a stem is capable of growing into a new plant. Plowing under simply spreads the plant by cutting the propagating stems and scattering the pieces. No very satisfactory way of eradicating weeds of this kind can be given that will apply for all cases and conditions. A straw mulch, by excluding the light, will sometimes kill them. Common salt applied to the soil is effective and arsenite of soda, one pound dissolved in eight quarts of cold water, is recommended. Of course, any chemicals that will kill weeds will kill all the other vegetation for several months. Chemicals methods of weed extermination, then, should be used only as a last resort and under expert advice.—Am. Gardening.

Nature's Sign-Posts.

When you discover that you are lost, first stop and pull yourself together, says a writer in St. Nicholas. Find a mature tree that stands apart from its fellows. Even if it is only slightly separated it will do. The bark of this tree will be harder, drier, and lighter in color on the south side. On the north it will be darker, and often at the roots of it will have a clump of mould or moss. On the south sides of all evergreen trees, gum, which oozes from wounds or knot-holes, will be hard and amber-colored. On the north, this gum is softer, gets covered with dust, and is of a dirty gray. In fall or winter, trees which show a rough bark will have nests of insects in the crevices on the south.

A tree which stands in the open land will have its larger limbs and rougher bark on the south side. Hardwood trees —the oak, the ash, elms, hickories, mesquits, and so forth—have moss and mould on the north. Leaves are smaller, tougher, lighter in color, and with darker veins on the south. On the north they are longer, of darker green, and with lighter veins. Spiders build on the south side. Any sawn or cut stump will give you the compass points, because the concentric rings are thicker on the south side. The heart of the stump is thus nearer to the north side. All these things are the effects of sun. Stones are bare on the south side, and if they have moss at all it will be on the north. At best, on the sunny side only a thin covering of harsh, half-dry moss will be found. On the south side of a hill the ground is more noisy under foot. On the north side ferns, mosses and late flowers grow.

Platinum Discoveries.

Platinum is one of the rarest metals in the world. It is specially valuable for chemical apparatus, because it is not injured by acids; the demand, however, is larger than the supply, for the mines in the Ural Mountains afford only about 12,000 pounds a year, which is nearly the total output. Under these circumstances, the mineral is very costly. This country has paid $170 a pound for a great deal of platinum that it has imported. About 95 per cent. of the world's supply of platinum thus far has been derived from the west side of the Urals.

There is now some hope that we shall be able to collect platinum in commercial quantities in our own continent. It is just announced that platinum in paying supply has been discovered at two places in Washington, near Princeton, and at the Olympia mine on Kennedy Mountain. Specimens of this ore taken from the Olympia mine were sent to a firm manufacturing platinum wares at Newark, N. J. The firm tested the ore and reported that it contained platinum in commercial quantities.

This firm wrote to Washington, asking for information as to the probable amount of platinum available. On account of deep snow it was impossible to make other researches during the winter, but the ground near where the finds were made has been staked and the claims will be thoroughly investigated this spring.

In December last the Dominion Government sent an expert to the Klondike to investigate the platinum discoveries reported to have been made there. The expert was sent on the strength of a report made by C. S. Hurter, a government metallurgist, who reported that in the Yukon gold brought to him last year was a considerable quantity of platinum, whose presence the miners had not discovered. Many very small nuggets of platinum were mixed with coarse gold. Mr. Hurter gave it as his opinion that the miners of the Yukon were throwing away thousands of dollars' worth of platinum daily.

The amount of this metal produced in the Ural region is quite variable. In 1890 the yield was 6,363 pounds, while in 1899 it was 13,242 pounds. For several years the average production has been about 12,000 pounds. It will be a great boon if the metal found in our own country and Canada proves to be in commercial supply, for the price is now excessive, and it desirable that the output be augmented.

Electro-Magnetic Gun.

Several severe experiments have recently been made in Christiania with a new electro-magnetic gun invented by Prof. Birkeland. The electric connection between the battery and the gun is made in less than a second by the aid of a current breaker. The feature of this weapon is that no noise accompanies its firing. In the trials the electric spark was first seen, followed by a loud report, which was caused by the impact of the projectile, a 1 pound shell on a wooden target, which was penetrated. The gun works magnetically. The shell is drawn out of the bore, and not, as hitherto, impelled by gunpowder. The use of magnetism as a motive power, according to Prof. Birkeland, will enable 1,000 pound shells to be hurled much further than by the old-fashioned methods. This is by no means the first gun with which attempts have been made to fire shells by magnetic means, but no electro-magnetic gun has yet succeeded in fulfilling the requirements which were claimed for it, so that Prof. Birkeland's further experiments will be followed with great interest.

Archaeology

THE PICTURED CAVERN OF COMBARELLES.

BY THE MARQUIS DE NADAILLAC.

I have already mentioned the important finds recently made in the south of France, dating from the quaternary period. I am happy to have now in my possession some of these figures, and to be able to present them to the readers of POPULAR SCIENCE NEWS, as one of the greatest discoveries in anthropology.

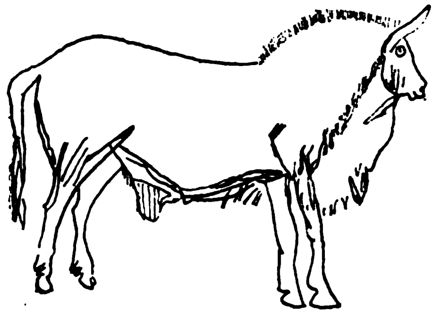


FIG. 2.

The cavern of Combarelles near Tayar (Dordogne) consists of a long trench about 234 metres in length, from 1 to 2 metres in breadth, and from 1 m. 60 to 1 m. 75 in height. The figures so happily discovered by Dr. Capitan, begin at about 118 metres from the mouth of the cavern, and cover both sides of the wall for an approximate length of a hundred metres. They begin at a distance of 15 or 20 centimetres from the floor and reach the whole height of the cavern. The floor is always covered, and the walls often also, with a thick layer of stalactites or stalagmites; but this fact alone cannot give us a date, as the formation of stalagmite varies greatly according to the atmospherical or chemical conditions, and cannot carry any certitude.

The figures in the cavern of Combarelles are numerous, more numerous than in any of the caverns yet explored, but they are often so mixed up together that it is with great difficulty that Capitan follows the exact lines and with a still greater difficulty that he is able to reproduce them with the help of electrical lamps. On some of the figures the stone has been scraped, so as to make the head appear with a certain relievo. The technical part is the same as on the worked flints d bones numerous in the south of France and dating from the Magdalenian period. These stones or bones representing, either in drawing or sculpture, mammals, fishes, serpents, man himself, are only found, with one exception, in the south of France. The exception is Thayngen, in Switzerland, where some of the best specimens of the work of the Troglodytes were found.

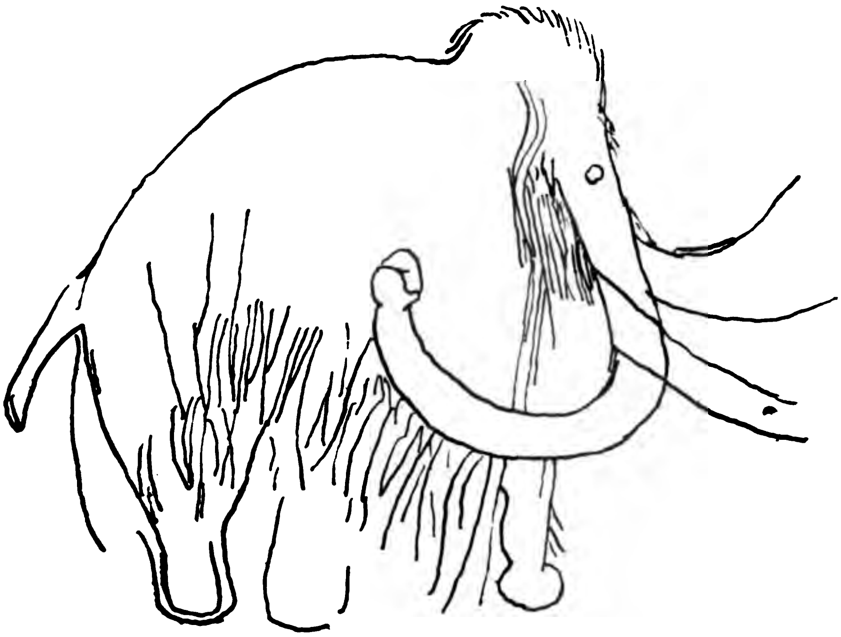


FIG. I.—ELEPHAS PRIMIGENIUS.

The reason why the figures remained so long without being brought to light after the first exploration of the cavern, is easy to explain. The Troglodytes always remained at the entrance of the cavern which they inhabited, did their cooking and their daily work, and where their remains are now found. Some stragglers went further, and to them are due the figures, perhaps the protecting deities of the tribe, now found.

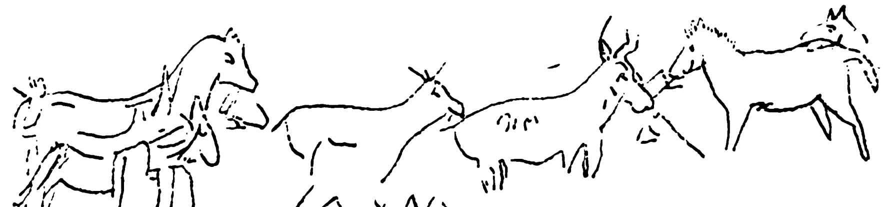


FIG. 6.

It is impossible to give a name to many of them. In certain places they are engraved on the rock to a depth of five or six millimetres, in others they are covered with stalactites; but wherever they were, the workmen who executed these remarkable drawings, had only at their disposal stone, horn or bone tools, miserably pointed.

The animals which they reproduced lived certainly amongst them. On this point no doubt is possible. We find the mammoth (Elephas primigenius) (Fig. 1) till nearly the end of the quatenary period, and he was certainly the contemporary of the man who traced him on the walls of what was his habitation. There have been found at Combarelles 14 elephants of different ages, with or without hair on their bodies. The most numerous animals are certainly the Equidés (Figs. 2, 3, 4). Two distinct races were known to the Troglodytes. Some have the thick head of our wagon horses, the straight mane, the bosky nose, the tail abundantly covered with hair. Others have a smaller head and more delicate forms, the nose is less curved, the tail is sometimes implanted higher, sometimes also lower, as we see it in the bovidés.

The equidés are not only noticeable for the correctness of their forms, which is astonishing if we go back to the time in which they lived, but still more by the new light they throw on an incalculable past. One of them (Fig. 3) carries the remnants of a bridle, perhaps of a halter; another a sort of covering (Fig. 4); the last a cord. Two others have a private mark which, for Capitan, is a sign of proprietorship. Are we then to conclude, that the contemporaries of the mammoth, the oldest known inhabitants of our part

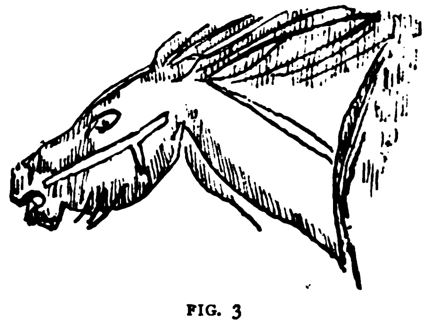


FIG. 3

of the world, living in caves, having only arms or tools in stone, ignoring, perhaps, the use of pottery, were not barbarians just removed from animality, and that at this early period, they had already succeeded in domesticating horses and other members of the equine tribe?

Dr. Capitan, late President of the Anthropological Society, of Paris, is very positive on the existence of the covering, the halter or bridle, and as he is the only person who has seen, studied, measured and copied these figures, his opinion must carry great weight. Nevertheless, it is difficult to admit that in those days animals lived in the society of man and were domesticated by him. A learned member of the Institute writes to me: "They were not domesticated but only tamed." I confess, I do not see a great difference between the two words, and if a horse can be brought to carry a bridle and drag a burden, he is to all intents and purposes domesticated, and the servant of man. When the discoveries of Combarelles are confirmed by other discoveries of the same sort and allow us to be more positive, a great point will have been settled.

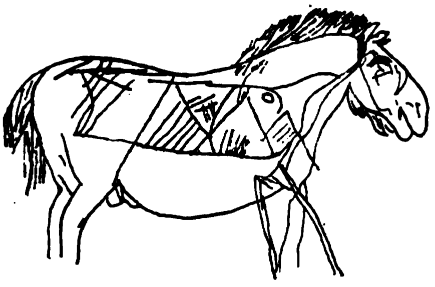


FIG. 4.

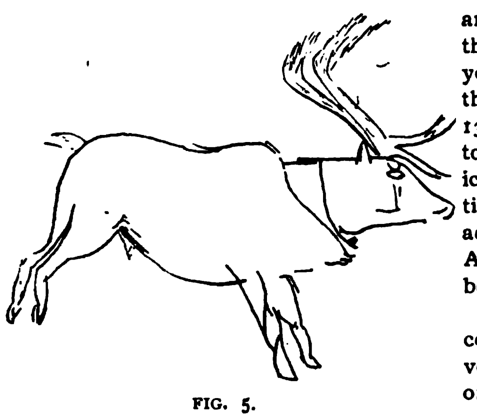


FIG. 5.

But if the question of the domestication is not yet completely elucidated, one thing certainly remains; the men who executed those drawings in the cavern of Combarelles were truly artists. Look at the bovidés, no less remarkable than the équidés, at the antelope gnu, that still lives in the south of Algeria; look at the reindeer (Fig. 5), his bearing, his exact proportions; look at the cervides grouped together (Fig. 6). Certainly, no one can deny the artistic genius of our remote ancestors and the early beginnings of art in the south of France.

Yeast Plant Cells.

The cells of the yeast plant have been discovered by the microscope in bread more than 4,000 years old, found in an Egyptian tomb.

Origin of American Indians.

Mr. Charles Hallock, of Washington, D. C., has republished his recent article, from the American Antiquarian, on this interesting subject. He summarizes it thus: The Indians, or Indigenes, of both North and South America, originated from a civilization of high degree which occupied the subequatorial belt some 10,000 years ago while the glacial sheet was still on. Population spread northward as the ice receded. Routes of exodus diverging from the central point of departure are plainly marked by ruins and records. The subsequent settlements in Arizona, New Mexico, Colorado, Utah, and California, indicate successive stages of advance, as well as the persistent struggle to maintain the ancient civilization against reversion and the catastrophies of nature. The varying architecture of the valleys, cliffs, and mesas, is an intelligible expression of the exigencies which stimulated the builders.

The gradual distribution of population over the higher latitudes in after years was supplemented by accretions from Europe and northern Asia at least 2,000 years before Columbus came. Wars and reprisals were the natural and inevitable results of a mixed and degenerating population with different dialects. The mounds which cover the mid-continental areas, isolated and in groups, tell the story thereof. The Korean immigration of the year 344, historically cited, which led to the founding of the Mexican Empire in 1325, was but an incidental contribution to the growing population of North America. So also the very much earlier migrations from Central America by water across the Gulf of Mexico to Florida and Arkansas, and to the islands of the Caribbean Sea.

In the course of the author's treatise, corroborative evidences are presented to verify the main proposition, the relevancy of which careful readers must fain admit.

Origin of Totems.

Mr. Francis LaFlesche gives a legend of the Omahas and Osages, bearing on the origin of totems. When they were as one tribe they were very poor. They said 'No one can help us but the magic power of Wakanda.' The children put clay on their faces and prayed to Wakanda. Then they got power to make bows and arrows and they blessed the bows and arrows, and in order to preserve the art they set apart a clan. They made houses, etc., and divided the families into clans. The buffalo, elk and turtle, for instance, are not worshipped as totem animals, but are a means through which Wakanda is worshipped. Mr. LaFlesche describes the way men get Wakanda. A hole in shape of a house is made in the ground beneath the grass roots, and the man stands before it and cries to Wakanda; he makes no definite petition, but cries for strength. Perhaps a wolf appears; it is a vision; he preserves that vision by killing a wolf, and takes the skin, or an ear, or tail, and this becomes his totem from Wakanda.

To Archæologists.

The fifty-first meeting of the American Association for the Advancement of Science will be held at Pittsburg, Penn., June 28th to July 3d, 1900. Mr. Stewart Culin, of the University of Pennsylvania, will preside over the Section of Anthropology. Anthropologists are cordially invited to attend, and contribute papers upon subjects connected with their fields of research. Several members of the section have informally expressed the desire to devote at least one day to papers and discussions on anthropological museums and their cases, methods of installation, and technique; also that papers should be offered on the more important special collections in museums, both in this country and abroad.—Harlan I. Smith, Secretary Section H, Am. Mus. Nat. Hist., N. York.

Speculative Science.

To those who can read the signs of the times it is most evident that zoology has been passing through a period of revolution during the past ten years. A strong reaction has set in against the extremely speculative theories as to the factors of evolution, the inheritance or non-inheritance of acquired characters, and the whole 'phylogeny business' of a dozen years ago. The present attitude of most zoologists is more critical, less argumentative and in all respects more wholesome than prevailed when sky-scraping theories were erected on a single square foot of fact. In this wholesome reaction experimental morphology has played a most important part; in fact, it was the attempt to make biology an experimental science which first aroused interest in this subject, and while at times some of these experimental morphologists have illustrated the uncritical methods which they have denounced, while their conclusions have often been open to the criticism of having been hasty and ephemeral, no one can deny the fact that their work has introduced a new spirit into the study of zoology.—Science.

Jerusalem's Water.

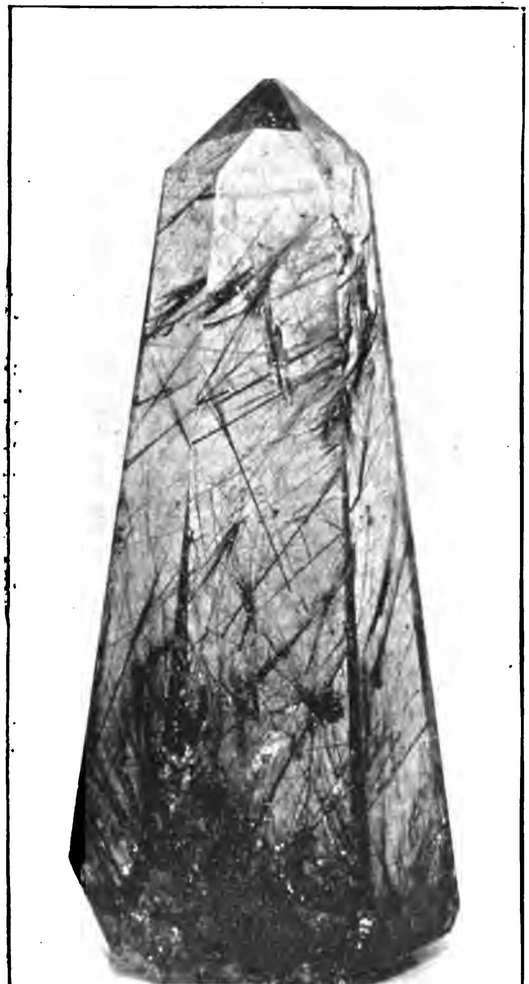
Residents and sojourners in Jerusalem are now enjoying "modern improvements" so far as water service is concerned, the new waterworks system being all finished. In Bible days the Holy Land was better supplied with water than to day, the denuding of the hills of timber having done what it has begun to do in the United States—reduced the rainfall and made the country arid.

The three springs which once furnished an abundant supply of water for Solomon's Pool now run only a gallon a second during the dry season. This water is now conducted to Jerusalem, where it is supplied to the people free.

Minerals

[Edited by A. C. Bates].

Striations on Quartz crystals are an interesting study. The parallel furrows on the surfaces of crystals are called striæ, and are more frequent in the rhombohedral system than in any other. Horizontal striæ are of almost invariable occurrence on the prismatic faces of quartz crystals. During their growth there seems to have been a continued effort to complete the crystals by the assumption of the terminal planes—which effort was intermittently overcome by a preponderating one to continue the deposition of matter along its main axis. Quartz crystals, from these alternate efforts often taper to a point without having any regular pyramidal face.



JAPANESE QUARTZ CRYSTAL.

The Sagauche County, Colorado, amethystine crystals admirably show the result of this effort to form a pyramid, and also the repeated striations that seem to have hindered the process. See Fig. 1. The common planes of the pyramid are never striated, but the uncommon planes, sometimes called rare, and all designated by a symbolic letter, are often striated.

Fig. 2 shows a unique quartz crystal from Lincoln Co., N. C. It is a crystal within a crystal, the inner one being well defined and attached at base on one side only. The outer and inner planes of the main as well as the planes of the central crystal are all nicely striated. The cause of this peculiar arrangement is a problem, but it may have been due to the hard red clay found in the pockets where the crystals occur imbedded in it, and which doubtless has been the cause of much of the freakishness exhibited in many of the crystals from Lincoln Co.

Quartz inclusions are often beautiful and are always interesting. The recent discovery of an immense pocket of quartz crystals in great variety near Butte, Montana, included some having inclusions of slender crystals of tourmaline radiating through them. Cross sections, cut from some of the larger crystals of quartz and polished, show the inclusions to be as good as any of the kind ever found.

The masses of rock-crystals of limped purity inclosing lustrous needles of rutile, found in the Island of Madagascar, excel in beauty all other forms of sagenitic quartz. In the North Carolina sagenites the quartz is rarely of fine quality, and where found, it is rendered nearly opaque by the mass of inclosed rutile. Some of the Swiss sagenite is of fine quality, and is perhaps, on the whole, more desirable as specimens, because the quartz is in crystal form.

The Japanese quartz crystals inclosing actinolite, as shown in the illustration, are very beautiful. The larger crystals are cut and polished in Japan, and their planes and angles suffer in the process, but the beauty of the inclusions is brought out more fully. The value of the specimen shown, which is full size, is twelve dollars.

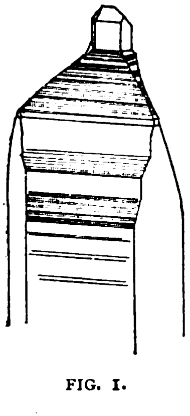


FIG. 1.

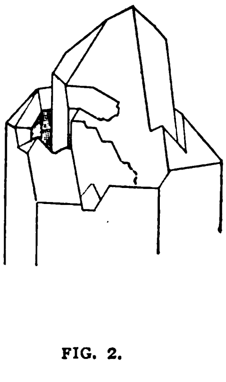


FIG. 2.

Quartz inclosing long blades of hornblende is found at Cumberland, R. I. The contrasted effect of the black and colorless minerals is very marked and pretty. Nearly all inclusions of quartz are used in jewely, cut into various fancy shapes—cabochon or ovals predominating—and good specimens appeal to lovers of odd things or rare forms, and thus there is always a market for all that can be supplied. Inclusions of flakes or bits of crystallized gold in quartz are sometimes found in the California mines, and these fetch generous prices. Rarely some less common minerals are included in quartz, as cinnabar, stibnite, proustite and muscovite.

The Brooklyn Institute have in their museum an excellent series of these inclusions.

Copper.—A correspondent in one of the New York daily papers writes interestingly about the "lost art of tempering copper," and concludes thus: "But, however antecedently improbable it may be that copper can be tempered, or that the art has been lost, one single copper tool, hardened to a cutting edge, would upset all a-priori reasoning. Does one exist? Has any reader seen such, and does he know of his own knowledge that it is as hard as wrought iron? I don't believe it, but I'd like something a little more definite to base my convictions on."

Cryolite is a fluoride of sodium and aluminum, and occurs in a granitic vein in a gray gneiss at Ivigtuk, Greenland. Crystals occur sparingly in cracks in the massive mineral. Cryolite is generally snow-white and translucent, and is mined extensively for commercial purposes, soda alum and aluminum being the chief products. There are several alteration products, as pachnolite, thomsenolite, prosopite, etc., which are comparatively rare, and although unattractive and costly, are sought after by collectors.

Stibnite.—It is reported that an assayer of San Bernardino, Cal., recently discovered in the Mojave desert 112 miles north of Randsburg, the largest and richest deposit of antimony ever found in the state. Fine specimens of stibnite, while not rare, have not yet been found so plentifully as to supply the demand for them.

Thunder Mountain, Idaho.—A news item states that crystallized gold is plentifully found, and also fine specimens of cinnabar, together with feldspar and quartz crystals. When, in mining for any of the metallic ores, quartz crystals are plentifully met with, it is safe to say that the section will yield good cabinet specimens of all the associate minerals.

The installation of the Bement collection of minerals in the American Museum of Natural History, made it possible for the curator to dispose of several hundred specimens of the old general collection, and, during the past three months, these duplicates have been sold by a New York dealer in minerals, to collectors all over the world, who had been waiting for just such an opportunity to secure good and rare minerals. This is one of the instances where a duplicate was not an abomination.

Spodumene is a metasilicate of aluminum and lithium, and is rarely found in small, neat crystals. Coarse, large crystals are common, and such are now being mined in great quantities in the Black Hills, of South Dakota, for the lithia they contain. The Etta mine, near Hill City, has produced many extraordinary large crystals. Hiddenite is a yellowish to emerald-green spodumene, containing a little chromium, and is mined at Hiddenite, N. C. Hiddenite crystals are small, one of two inches or more long being rarely found, and are mined for use as gems. A one carat hiddenite of perfect color and sound when cut, is valued at $150.

Muscovite.—People generally are inclined to look upon common mica as a mineral occurring sparingly in large or small isolated crystals, and not as a mineral filling veins which may be mined, as are other minerals. The Crown mine, of Custer Co., S. D., is turning out a daily product of one ton of clean mica. Electrical apparatus manufacturers are the chief consumers of mica.

Butte, Montana, produces more copper than any other camp in the world, yet all her wealth is practically derived from one hundred acres.

Onyx.—A vein of pure white onyx, five feet thick and flawless, has been discovered underlying a bed of limestone in Yavapai Co., Arizona. Some of the most beautiful variegated onyx now mined in the United States comes from this county, but no other deposit of pure white onyx is known to exist anywhere.

VOLCANOES.

BY J. L. WELLINGTON.

According to some of the old geographical definitions, a volcano is a mountain which sends out fire, smoke, and lava. This might answer for a definition were it not for two important facts: First, a volcano is not of the same formation as a mountain; and second, a volcano sends out neither fire nor smoke. The formation of volcanoes is composed entirely of the materials ejected from their craters, while mountains proper are formed by the folding or uplifting of the crust of the earth. What was long supposed to be fire escaping from the crater, was only the molten mass within the crater reflected on the vapors above, and very naturally the vapors themselves were supposed to be smoke.

A volcano is usually in the form of a cone, at the summit of which is a circular basin or depression called a crater. From the mouth of this crater there is a perpendicular shaft leading to the interior of the earth, and from this passage issue the products of the volcano; steam, gases, ashes, fragments of heated rock, and sometimes streams of melted rock called lava. These materials form themselves into a series of layers around the mouth of the crater, and it is to these layers that the conical form of the volcano is due. The more liquid the ejected materials, the broader and flatter are the cones. The volcanoes of the Sandwich Islands are noted for the liquidity of their lavas and an almost entire absence of ashes, which make them remarkable for their flattened form and the slight inclination of their slopes. In volcanoes where the lava is less liquid and ashes are in greater quantity, the slopes are steeper. Those which eject only fragments of rock are still more steep; as the volcanoes of the Andes.

Ashes from volcanoes, when examined, show no resemblance to real ashes, but are found to be simply pulverized lava. These ashes sometimes form a powder and are carried by the winds for hundreds of miles. At times, huge fragments of rock are thrown out with great violence. It is said that during an eruption of Cotopaxi, in Mexico, a mass of several tons weight was hurled a distance of seven miles.

A stream of white hot lava flowing from a crater, bears a great resemblance to molten iron escaping from a furnace. The surface of the lava soon forms into a crust, but the interior remains in the melted state and continues to flow. It is said if the stream is thick, the molten lava will remain warm for ten or even twenty years.

It is difficult to comprehend the amount of matter ejected by volcanoes. Hawaii, the largest of the Sandwich Islands, is formed entirely of the materials thrown out by its four craters. All high oceanic islands are of the same character. Iceland, a table-land with an area of 40,000 square miles and from 3,000 to 5,000 feet in elevation, is composed of volcanic rock similar to the lavas still ejected by its numerous volcanoes.

The most carefully studied, as well as the most active volcano in the world, is Vesuvius; and it is from this that most observations are made. It should be understood that volcanoes are not always active; long periods of comparative repose intervene between eruptions. Among the indications of an approach of an eruption, are the drying up of the wells in the vicinity of the volcano—probably due to the increase of heat in the ground—loud explosions heard underneath the surface of the earth, and the large increase in the volume of steam escaping from the crater.

The eruption generally begins with a tremendous explosion and great clouds of steam are hurled into the air. This is followed by other explosions in rapid succession, and soon a huge column of vapor, ashes, sand, and fragments of red-hot lava, is formed. When this great cloud is checked in its ascent by the force of gravity, it spreads out and forms itself into a shape similar to a great umbrella. In one eruption of Vesuvius the height of this cloud was estimated at 10,000 feet. Finally, the molten lava overflows the rim of the crater and descends in torrents down the slope. All the lava that finds its way to the surface, does not, however, escape through the crater, but often is expelled through fissures in the slope far below the summit. After the lava is expelled the eruption is generally near its end, though it does not necessarily terminate then. The out-bursting of steam, lava and ashes, may continue alternately for weeks or even months.

What is called a period of eruption, is really a series of eruptions extending over several years, during which indications of activity are still numerous. It is said that the periods of eruption of Vesuvius have been separated by centuries of almost absolute repose. At the beginning of the Christian era the crater of Vesuvius was nearly full and covered by forests. Its slopes abounded with grain-fields, villages and cities. In the year 63, the inhabitants of these cities and villages were startled by shocks of earthquake. Sixteen years later, the first eruption of the volcano took place. The rain of hot, wet ashes being so great as to cover whole neighborhoods, and burying the flourishing cities of Herculaneum and Pompeii. The two cities have recently been exhumed from beneath several yards of volcanic matter. No lava, however, is mentioned in the descriptions of this eruption.

From the eruption which buried the two cities mentioned, to the year 1306, only seven eruptions are recorded. At one time the volcano was almost extinct for 500 years. In 1631, when it had been so long dormant that the slopes were being cultivated to its summit, an eruption took place which surpassed all others in destructiveness. The umbrella-shaped mass of vapor and ashes extended above the clouds, and, spreading out in every direction, covered a large region of country with volcanic materials and destroyed all vegetation. The drift of ashes extended eastward even beyond the Adriatic Sea. Streams of red-hot mud and lava rushed down the slope to the sea, completing the work of destruction. This eruption lasted for three months and destroyed a number of cities and villages. A rest of thirty years followed, but from 1660 eruptions have occurred at intervals not exceeding ten years.

Bacteria on Money.

A physician, through bacteriological investigation made at the Hôpital du Bey, Algiers, has found that almost all varieties of bacteria occur upon currency, but most common are the germs of suppuration. Bacteria are, however, short-lived upon metal currency.

APPARENT DURATION OF A LIGHTNING FLASH.

BY DANIEL F. COMSTOCK.

Perhaps one of the most striking of optical illusions is the apparent traveling of a lightning flash across the sky. Every one is familiar with this common occurrence, but few have ever stopped to inquire whether there was in reality any perceptible motion to the flash.

Now it is easily shown that, with the possible exception of "ball lightning," no motion detectable by the human eye really exists. Of course, there is no means of experimenting upon the lightning itself, but we have a most excellent miniature, zigzag flash and all, in the discharge of a Wimshurst machine. Suppose now that we take a small disc, cut in the shape of a wheel, and rotate it very rapidly. Under ordinary circumstances there will be simply a blur caused by the rapidly passing spokes. If, however, we completely darken the room and use the miniature lightning flash of a Wimshurst machine as our only means of light, we shall find that, however rapidly the wheel may revolve, it will, at each flash, appear absolutely stationary, and each spoke can be clearly seen.

What is to be drawn from this striking experiment? We are able to see only while it is light, and it is light for such a minute instant that the wheel, while visible, does not have time to move the hundredth part of an inch.

By means of experiments similar in principle to that just described, it is known that a lightning flash may last only one-millionth of a second and this, of course, is far beyond eye detection. We see the flash but, as far as sight is concerned, it occurs instantly and the appearance of motion is a pure and simple optical illusion.

The author recalls an amusing instance of two men who once came to him and asserted that they had both distinctly seen the same flash travel. Their agreement was turned to discord, however, when they were asked which way it had gone, for one said "up" and the other "down," and they almost came to blows as a consequence. The illusion is probably due to the fact that some parts of the retina of the eye are more sensitive to light than others, and hence the impression on the brain is not quite instantaneous.

Mass. Inst. of Technology.

A Heavy Gospel.

In one of the convents of Hagion Oros in Macedonia, the ancient Mons Athos in Chalcidice, the seat of theology, in the monastery of Ton Tueron, there is the weightiest gospel that was ever heard or read of. Bound in silver plates, set with diamonds, and 1 metre in length, it weighs 30 Greek okes, equal to 85 lbs., English. Two deacons bear it when it issues forth in solemn procession twice a year, on Easter Day and Our Lady's Day.

Photography

THE GLYCERINE PROCESS.

The glycerine process of developing platinotype prints by application of the developing agent with the brush, is perhaps one of the most interesting and fascinating of photographic processes, owing to its far-reaching possibilities, and is now being employed by the best amateur and gallery photographers.

FROM AN UNMANIPULATED PRINT.

The use of glycerine in combination with the developer used in developing platinum paper is not new. Its most valuable and far-reaching possibilities, however, appear to have been overlooked entirely or to have been beyond the visual range of those who originally introduced the use of glycerine in connection with the finishing of platinum prints. Originally it seems to have been regarded simply as a medium whereby clear high lights might be obtained in prints together with a modification of the heavy shadows. Later it came to be regarded as "a valuable and useful means of mechanically restraining or retarding the development," while one of the most recent articles upon this subject treats of it as an eliminator of unnecessary and obtrusive detail and warmly champions this property as its greatest virtue. And there are still many who believe that its sole value lies in the possibility it affords of making passable and even pleasing prints from negatives that would not yield by any other means an even half satisfactory picture.

By this method of developing platinotype paper, many negatives, which have been discarded on account of the dim, flat, non contrastive results which they yielded, may be employed with surprising results, and, in the hands of one possessing a little artistic skill, vivid, animated pictures may be obtained. On the other hand, from the sharp and hard negative, soft, sketchy effects may be secured.

There are required for this process at least four, or preferably five, glass jars: No. 1, to contain pure glycerine; No. 2, equal parts glycerine and normal strength platinotype developer; No. 3, one part glycerine and four parts developer; No. 4, undiluted developer, and No. 5, the same as No. 3, with the addition of such proportion of saturated solution of bi-chloride of mercury as is necessary to obtain the tint desired. Also not less than four soft brushes, varying from the fine "spotter" or Japanese brush to the 1½ or 2 inch camel's hair, and several pieces of special blotting paper.

Operation: — Print the paper a trifle deeper than for the ordinary method of developing. Place the print face-up on a piece of clean glass (should the print curl so that it is unmanageable, moisten the glass with glycerine), and, with the broad camel's hair brush, thinly coat the entire print with pure glycerine, blotting same off in thirty or forty seconds; then re-coat more thickly such portions as are desired especially restrained, or the details partly or entirely eliminated. Now brush or paint such portion of the print as is first desired brought out with solution No. 2, (equal parts glycerine and normal developer), blotting the portion being developed from time to time to avoid developing too far. Should more energetic development or more contrast in effect be desired, employ solution No. 3. No. 4 (full strength developer), is applied when a pronounced or deep black is wanted.

The use of No. 5 produces a deep warm brown tone, the proportion of mercury being one dram to each ounce of developer. By reducing the amount of mercury a lighter brown is yielded until, by further reducing, the "flesh tint" in portraits, etc., is acquired. When any part of the print has reached the full development desired, blot that portion carefully with the blotter, coat with pure glycerine, and proceed as before.

FROM SAME NEGATIVE, DEVELOPED BY THE GLYCERINE PROCESS.

When the print has reached complete development, place in hydrochloric (muriatic) acid bath, one part acid to sixty parts water), when such portions not affected by the developers will be washed out, leaving pure whites. Prints should be given three of these acid baths and allowed to remain in the first, five minutes; in the second, ten minutes; in the third, fifteen minutes, being occasionally moved about. Then wash in running water forty-five minutes. In cases where mercury is used, give prints but two acid baths of 5 minutes each, and wash for 30 minutes in running water.

For the description of this process and examples of its work, we are indebted to W. E. Wilmerding and Alfred Stieglitz.

THE LIQUEFACTION OF HYDROGEN.

BY FREDERICK H. GETMAN.

No chapter in physical science reads with greater charm than does that which treats of the liquefaction of gases. No problem of experimental science has demanded greater skill and none has offered greater resistance to solution. Notwithstanding the many difficulties which beset the solution of the problem, less than a century was required to condense all known gases into the liquid state. The last of the so-called "permanent gases" to be liquefied was hydrogen, and it is my purpose to give a brief resumé of the various attempts made in this direction, and then to record the final successes in bringing this gas into line with its associates.

In the Proceedings of the British Association for the Advancement of Science for 1838 we find an account of certain experiments by Maugham in which he endeavored to liquefy hydrogen and oxygen by the electrolysis of acidulated water in closed U-tubes of very strong glass. The pressure thus produced was sufficient to burst the strongest glass tubes, but neither gas was liquefied. In 1843 Aimé experimented on various gases, hydrogen among them. He obtained his pressure by sinking the gases in suitable vessels to great depths in the ocean. The objection to the method is obvious at once, since he could not see what was taking place in the vessel. He subjected hydrogen to a pressure of 220 atmospheres without obtaining any evidence of liquefaction.

Faraday, who gave the initial impulse to the study of the liquefaction of gases by condensing chlorine to a liquid in 1823, published in 1845 a second series of observations in which he records his attempts to liquefy nitrogen, oxygen and hydrogen, by subjecting them to the simultaneous influence of great pressure and extreme cold. The pressure was produced by two air-compressors and the cold by means of Thilorier's mixture of solid carbonic acid and ether. At the lowest temperature obtainable he could observe no signs of liquefaction. Though his experiments were futile, yet with that marvelous insight so characteristic of him, he predicted that if the temperature could be sufficiently reduced, the gases would pass into the liquid or even the solid state.

Almost simultaneous with the experiments of Faraday, was the work of Natterer, who constructed an apparatus with which he could obtain pressures of 3,600 atmospheres, or 54,000 pounds per square inch. His results on hydrogen were wholly negative, and he drew the conclusion that it could not be liquefied.

In 1861, Andrews studied the effect of high pressures and low temperatures on the volumes of various gases among which was hydrogen. While the results were negative, yet they led him to make the careful study of carbonic acid gas, which was epoch-making in the history of the liquefaction of gases. Clerk Maxwell says in his Theory of Heat, "the experiments of Andrews on carbonic acid furnish the most complete view hitherto given of the relation between the gaseous and liquid states of matter, and of the mode in which the properties of a gas may be continuously and imperceptibly changed into those of a liquid." The outcome of his experiments may be summed up in the statement that beyond a certain temperature, called the "critical temperature," the gas cannot be condensed to a liquid, however great the pressure may become.

At a meeting of the French Academy of Sciences in 1877, a message was received from Cailletet, telling of his success in liquefying oxygen and carbon monoxide. To this dispatch was appended the following postscript: "I have just made an experiment which sets my mind greatly at ease. I compressed hydrogen to 300 atmospheres, and after cooling down to -28°, I released it suddenly. There was not a trace of mist in the tube. My gases, carbon monoxide and oxygen, are therefore about to liquefy, as this mist is produced only with vapors which are on the verge of liquefaction. The prediction of M. Berthelot has been completely realized." The following year this same experimenter tried again to liquefy hydrogen, using a pressure of 280 atmospheres and a temperature of -29°. When the pressure was suddenly released, a very fine mist was seen to collect on the walls of the tube which vanished within an extremely short time. He repeated this experiment in the presence of Berthelot, Saint-Claire Deville and Mascart, all of whom substantiated his claim to have liquefied the gas.

At the same time that the problem was being studied by Cailletet, it was receiving attention from that other experimenter whose name has come to be associated with his, Raoul Pictet. The apparatus of Pictet was very different in form from that of Cailletet, so that he can justly claim to have reached his results wholly independently.

He succeeded in obtaining liquid hydrogen as a bluish jet from a fine aperture. The jet soon became intermittent, from which he concluded that the opening in the tube was stopped with solid hydrogen, and there seems to be little doubt as to the correctness of his conclusion. To these two men belongs the credit of having first condensed hydrogen to a liquid.

Early in 1884, the following note was received by the French Academy from Wroblewski: "Hydrogen cooled by boiling oxygen is liquefied by release of pressure." In the Comptes Rendus for that year, we find an account of his experiments. The gas was subjected to a pressure of 100 atmospheres in a small glass tube which was surrounded by boiling oxygen. When the pressure was suddenly released, signs of ebullition were observed in the tube which showed that some of the hydrogen had been liquefied.

A little later in the same year, Olszewski liquefied hydrogen. He compressed the gas to 100 atmospheres by means of a Cailletet pump and cooled it by means of liquid oxygen under atmospheric pressure. He prevented the heating of the liquid oxygen by means of a bath of liquid ethylene, and was thus able to maintain it in the liquid state for a long time under atmospheric pressure. The temperature not being yet low enough to liquefy the hydrogen, he proceeded to boil the oxygen in a vacuum. This failing, he sought to lower the temperatute by means of liquid air, but these experiments were unsuccessful. He then returned to liquid oxygen as a refrigerant, boiling it under a pressure of 6 mm. of mercury and subjecting the gas to a pressure of 190 atmospheres. Under these conditions, hydrogen showed no meniscus, but when the pressure was suddenly released, a rapid momentary ebulition could be observed and small colorless drops could be seen to condense in the upper part of the tube. He concluded that with liquid oxygen boiling under reduced pressure as a refrigerant it would be impossible to obtain liquid hydrogen in a static condition.

Shortly after the experiments of Olszewski, a very important step was taken in the introduction of the so-called "regenerative method" of liquefaction, and before taking up the work of Dewar, who has perfected the liquefaction of hydrogen, it will be well to get a clear notion of the principle underlying this method. In all of the experiments which have been cited up to this point, the cooling of the gas has been effected mainly by means of the evaporation of liquefied gases, especially under reduced pressure. In the regenerative process the gas to be liquefied is made to cool itself. It is first subjected to very high pressure, and the heat produced in compression is taken up by means of a circulation of water; the gas is then allowed to expand, taking up heat from itself, and producing in this way extremely low temperatures. The compression and expansion taking place quickly, enables us to consider the process as isentropic, and a simple application of thermodynamics gives us the theoretical cooling produced. By making successive substitutions for p in the well-known formula $\left(\frac{p}{p_1}\right)^{\frac{k-1}{k}} = \frac{T}{T_1}$ where $T = 273$, and $p_1 = 1$ atmosphere, we can calculate the cooling which should be produced by the pressures applied. Ostwald gives a table for air where $k = 1.41$, showing the cooling produced:

p	T_1
100 atmospheres	71.°5
200 "	58.°5
300 "	52.°0
400 "	47.°9
500 "	44.°8

Of course, in practice we do not realize what theory indicates, but in the hands of Linde, Hampson, Tripler and Dewar, this method has given results which could never have been obtained by the older processes.

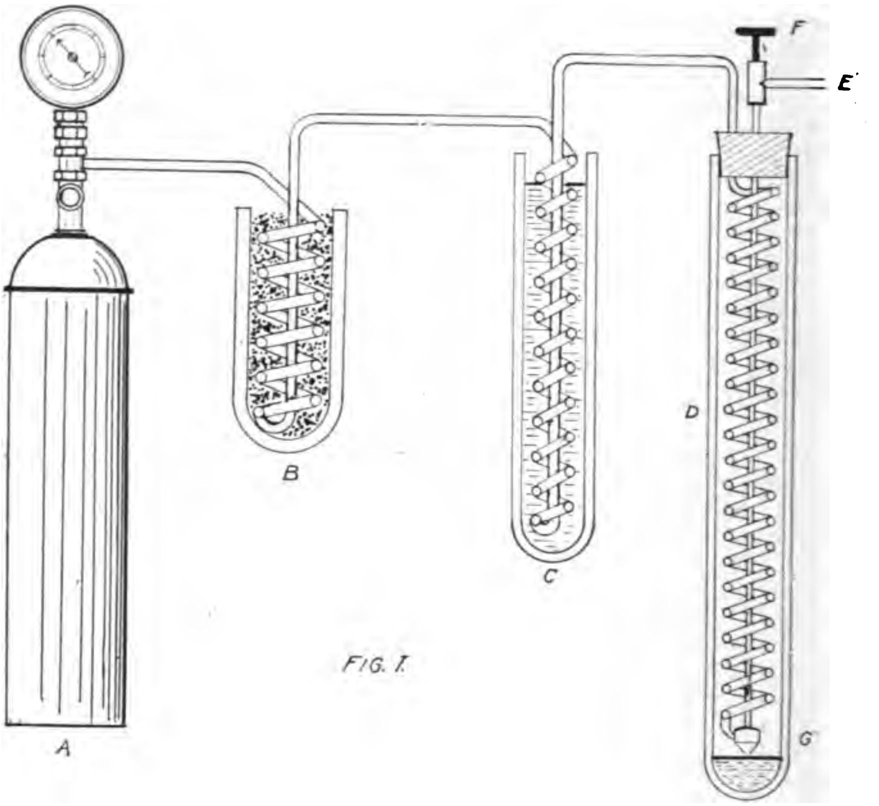


FIG. 1.

On the 19th of December, 1895, Dewar read a paper before the Chemical Society, on the "Liquefaction of Air and Researches at Low Temperatures." In this paper he describes a form of apparatus devised by him, in which he makes use of the principle of regeneration. He compressed the air to 150 atmospheres and cooled it to nearly —80° by means of liquid carbon dioxide before allowing it to expand in a regenerative coil. In about fifteen minutes from the time of starting, liquid air began to drop into the vacuum vessel placed below the coils. In this way Dewar was enabled to liquefy air and oxygen on a comparatively large scale.

He also made some experiments on "gas jets containing liquid." For these experiments a small regenerative coil was placed in a long vacuum vessel and the compressed gas was allowed to expand from the coil near the lower end of the tube. Oxygen cooled to —79° by liquid carbon dioxide and then compressed to 100 atmospheres gave a visible jet of liquid.

Similar experiments were made with hydrogen. This gas was cooled to —200° and then allowed to expand from a pressuse of 140 atmospheres. No liquid jet could be seen if the hydrogen was pure, but if it contained a few per cent. of air or oxygen, the liquid jet became visible. By increasing the length of the coil and subjecting the gas to a pressure of 200 atmospheres and a temperature of —200°, a liquid jet could be seen when the gas was allowed to expand. It was impossible, however, to obtain liquid hydrogen in a static condition. In order to get some idea of the temperature of the liquid jet, Dewar placed some liquid air and liquid oxygen in the end of the tube, and within a very few minutes these liquids were converted into hard snowlike solids.

In 1898, Dewar succeeded in obtaining liquid hydrogen in the static condition. The main change made in his process was in the substitution of a mixture of hydrogen and nitrogen for oxygen or air as refrigerants. In speaking of this method, Dewar says: "One thing can, however, be proven by the use of the gaseous mixture of hydrogen and nitrogen, viz.: that by subjecting it to a high compression at a temperature of —200° and expanding the resulting liquid into the air, a much lower temperature than anything that has yet been recorded up to the present time can be reached. This is shown by the fact that such a mixed gas gives, under the conditions, a paste or jelly of solid nitrogen, evidently giving off hydrogen, because the escaping gas burns fiercely."

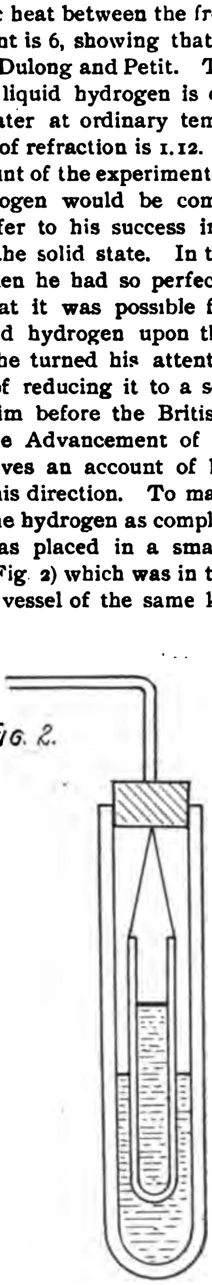
In the Proceedings of the Royal Society for 1898, we find a preliminary note from Dewar on the liquefaction of hydrogen and helium. To quote his own words: "On May 10th, starting with hydrogen cooled to -205° C., and under a pressure of 180 atmospheres, escaping continuously from the nozzle of a coil of pipe at the rate of about 10 cubic feet to 15 cubic feet per minute, in a vacuum vessel double silvered and of special construction, all surrounded with a space kept below -200° C. liquid hydrogen commenced to drop from this vacuum vessel into another doubly isolated by being surrounded with a third vacuum vessel. In about five minutes 20 ccm. of liquid hydrogen were collected, when the hydrogen jet froze up from solidification of air in the pipes."

The liquid which he obtained was clear and colorless, showing a well-defined meniscus. Having no means at hand for determining the boiling-point of the liquid hydrogen, he immersed in the liquid a long glass tube sealed at the lower end. In a very short time the portion of the tube which was surrounded with the liquid hydrogen was filled with solid air which showed that the boiling point was extremely low.

In his lecture before the Royal Society given on June 13th, 1901, Dewar presents some of the physical constants of liquid hydrogen and compares the methods used in determining them. Besides determining the temperature with hydrogen and helium thermometers, he employed various electric resistance thermometers. Of the latter, he says: "The real law correlating electric resistance and temperature within the limits we are considering is unknown, and no thermometer of this kind can be relied on for giving accurate temperatures up to and below the boiling point of hydrogen." The mean boiling point of liquid hydrogen is 21°.0 absolute. The critical temperature is 30° absolute, and the critical pressure is 15 atmospheres. The average specific heat between the freezing and boiling point is 6, showing that it follows the law of Dulong and Petit. The surface tension of liquid hydrogen is 0.4 or $\frac{1}{18}$ of that of water at ordinary temperatures. The index of refraction is 1.12.

No account of the experiments of Dewar upon hydrogen would be complete that did not refer to his success in reducing the gas to the solid state. In the autumn of 1898, when he had so perfected his apparatus that it was possible for him to make liquid hydrogen upon the scale of 200 ccm., he turned his attention to the problems of reducing it to a solid. In a paper by him before the British Association for the Advancement of Science in 1899, he gives an account of his experiments in this direction. To make the isolation of the hydrogen as complete as possible, it was placed in a small vacuum test-tube (Fig. 2) which was in turn placed in a larger vessel of the same kind. The circular space between the two vessels was partly filled with an excess of hydrogen so that evaporation took place chiefly from the annular surface. By this arrangement the temperature of the outside of the inner tube and the temperature of the inside was the same, thus preventing the inflow of heat from the surrounding air. With such a combination the liquid hydrogen was evaporated under 10 mm. pressure without any signs of solidification.

FIG. 2.



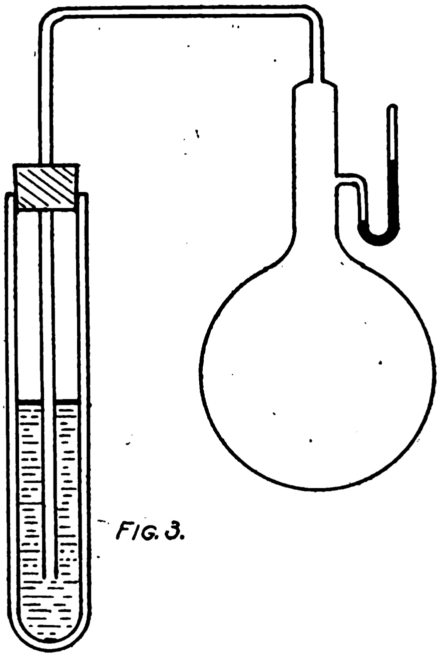


FIG. 3.

The failure of this experiment led Dewar to abandon the attempt to solidify hydrogen for the time until the gas could be obtained in larger quantities. He then directed his attention to determining the boiling point of liquid hydrogen by means of the platinum-rhodium thermometer. He says: "During the course of the present year many varieties of electric resistance thermometers have been under observation, and with some of these the reduction of temperature brought about by exhaustion was investigated. Thermometers constructed of platinum and platinum-rhodium (alloy) were only lowered 1½° C. by exhaustion of the liquid hydrogen, and they all gave a boiling point of -245° C., whereas the reduction in the temperature by evaporation in vacuo ought to be 5° C., and the true boiling point from -252 to -253° C.

In the course of these experiments it was noted that almost invaribly there was a slight leak of air, which became apparent by its being frozen into an air snow in the interior of the vessel where it met the cold vapor of hydrogen coming off. When conducting wires covered with silk have to pass through india-rubber corks it is very difficult to prevent leaks at these excessively low temperatures, when corks gets as hard as stone and cements crack in all directions. The effect of this slight air leak on the liquid hydrogen when the pressure was reduced below 60 mm. was very remarkable as it suddenly solidified into a white froth-like mass like frozen foam.

My first impressions were that this body was a sponge of solid air containing the liquid hydrogen, just like ordinary air, which is a magma of solid nitrogen containing liquid oxygen. The fact, however, that this white solid froth evaporated completely at the low pressure without leaving any substantial amount of solid air, led to the conclusion that the body formed must be solid hydrogen. This surmise was confirmed by observing that if the pressure and therefore the temperature, of the hydrogen was allowed to rise, the solid melted when the pressure reached about 55 mm. The failure of the early experiment must then have been due to super-cooling of the liquid, which is prevented in this case by contact with metals, wires and traces of solid air. He then proceeded to a second experiment in order to settle the matter definitely.

To a flask of nearly a litre capacity (Fig. 3), he sealed a small mercury manometer, and to the neck he sealed a long glass tube bent twice at right angles. The flask was filled with pure, dry hydrogen and then sealed off. The lower portion of the tube was calibrated and surrounded with a vacuum vessel containing liquid hydrogen and arranged for exhaustion. When the pressure became reduced considerably below that of the atmosphere, perfectly clear liquid hydrogen began to collect in the tube connected with the flask, and continued to collect until the pressure became 30 to 40 mm., when the liquid hydrogen surrounding the outside of the tube suddenly passed into a solid, foam-like mass, nearly filling the whole space.

Since the condition of the hydrogen could not be seen, the whole apparatus was turned upside down in order to see whether any liquid would run down the tube into the flask. Nothing ran down, however, so the hydrogen in the tube must have entirely solidified. When a strong light was placed on the opposite side of the tube from the eye, and the exhaustion maintained at about 25 mm., the solid could be seen to become less opaque, and the material in the tube connected with the flask was observed to be transparent like ice below, and frothy on the surface. The fact of this frothy surface prevented Dewar from obtaining the solid density, but he ascertained approximately the fluid density to be 0.086, the liquid at its boiling point having the density 0.07. The solid hydrogen melts when the vapor-pressure becomes 55 mm. The temperature of the solid was determined with two constant volume hydrogen thermometers, and was found to be 16° absolute or —257° C., under a pressure of 35 mm. The practical limit of temperature we can command by the evaporation of solid hydrogen is from 14° to 15° absolute. "The last doubt as to solid hydrogen having a metallic character has been removed," says Dewar, "and for the future hydrogen must be classed among the non-metallic elements."

Mining for Ice.

A company has been formed to put in practical use the ice caves in Clark's Valley, northern Arizona.

Hall's Journal of Health

Founded by Dr. Wm. M. Hall, 1854.

COMPARISON OF FOOD VALUES.

BY W. S.

During the last few years there has been such a great advance in the price of meats, that some suitable substitute for it would be a great boon to the poor. Americans as a class have an exaggerated idea of the value of meat as an article of food, and consequently eat more of it than is good for them. While some meat is almost indispensable to the maintenance of health, we would probably be better off if we consumed less meat and more fruit, cereals and vegetables. A diet of the latter foods is more healthful.

Scientific researches upon this subject by the various countries, in connection with the commissary of their armies, are of great value, for the conditions appertaining to these investigations are such that the results are necessarily accurate. They are able to experiment upon a large number of men, who are all subject to the same conditions of exercise and exposure, and fed upon the same quantity and quality of food.

What we should eat depends largely upon what we do. Men who are much in the open air, and are constantly exercising, require more meat than those of sedentary habits. Rheumatism and other complaints due to an excess of acid in the system, are often directly traceable to the inordinate use of animal food. These complaints can often be relieved, if not entirely cured, by abstaining from meat and drinking liberal quantities of water. There are many people who journey into a far country in order to drink the water from a particular spring, who would have experienced as much relief if they had stayed at home and drank the same quantity of water obtained from their usual source of supply. While water is not a panacea for all ills, it is undoubtedly true that we would be much more healthy if we consumed less stimulants and more water. This, together with an intelligent selection of nourishing food, would add much to the happiness of life.

Dr. W. Gilman Thompson, an authority on dietetics, compares the nutritive value of animal and vegetable foods as follows:

Errors in diet are far more common on the side of excessive meat-eating than the eating of too much vegetable food. The estimate commonly given, that meat should occupy one-fourth and vegetable three-fourths of a mixed diet, is overstepped by many persons with whom the proportions may be two to four. Meat seems to satisfy the cravings of hunger more than vegetable food.

Letheby says that the best proportions for the common wants of the animal system are about nine of fat, twenty-two of flesh-forming substances and sixty-nine of starch and sugar. A mixed diet is the only rational one.

Speaking of vegetarianism, Dr. Thompson says:

In regard to an exclusive or almost exclusive vegetable diet for man, the universal experience has been that while it may keep him in apparent health for some time, it eventually results in a loss of strength and general resisting power against disease, which becomes evident after some months, if not before.

It is impossible to subsist for any length of time on a diet that does not contain a considerable quantity of nitrogen. A purely vegetable diet gradually induces a condition of muscular weakness and languor, with disinclination for either physical or mental work.

Following is an approximately correct table of food values. It shows the nutritive properties of the common food products:

MEATS.	Water.	Albumen.	Starch, fat and sugar.	Salts.
Ox (lean)	76.7	20.7	1.5	1 2
Mutton	76.0	17.1	5.7	1.3
Chicken	76.2	19.7	1.4	1.3
Mackerel	71.2	19.4	8.0	1.3
Salmon	64 3	21.6	12.7	1.3
CEREALS.				
Buckwheat flour	13.5	8.9	75.9	1.0
Corn flour	14.2	9.7	73 3	1.8
Graham flour	13 0	11.7	71.6	1.8
Oat flour	7.7	15.1	74.3	2.0
Rice	12 6	6.7	79.4	8.0
Rye bread	42.3	6.1	49.6	1.5
Whole wheat bread	45.1	5.3	48.11	0.5
VEGETABLES.				
White bean	15.0	26.9	51.8	3 5
String bean	88.7	2.7	6.7	0.6
Carrot	86.8	1.2	0.3	0.1
Cauliflower	90.9	2.5	1.5	0.8
Lettuce	94.3	1.4	0.3	1.0
Green pea	12.7	21.7	59 6	2.8
Potato	75.0	2.2	0.2	1.0
Tomato	92.4	1.6	4.4	0.6
Sweet potato	71.8	1.0	2.0	0.7

OCCUPATION AND LONGEVITY.

Dr. Arlidge, an English physician, has recently published the results of years of close study of longevity, and his conclusions are instructive and valuable. Dr. Arlidge has decided that the indolent rich are the shortest-lived of all classes, and gives as the cause of this seeming anomaly that they worry their lives away. The farmer stands at the head of the list of long livers; he generally has to toil hard, but his work is in the open air, and in an altogether healthy environment. Good digestion with him waits upon appetite, and he eats heartily of wholesome food, which nourishes his frame and makes good red blood.

Next in order of longevity are the clerical, legal, and medical professions. The clergyman in the country leads a life somewhat closely resembling that of the farmer; he is much out of doors, his hours are necessarily regular, and he is precluded by the nature of his calling from dissipated habits of a worldly sort. The lawyer's lines, so far as health is concerned, are not cast in such pleasant places. His life is a more strenuous one, generally full of excitement, with the brain kept for most of the time at high pressure, and the nerves on the strain. Of the three learned professions, the physician can calculate on the shortest life. A conscientious doctor must of necessity be the most self-abnegating of men; and, as a rule, he has little or no time to think of himself, as his mind is continually burdened with the responsibilities of his practice. In both town and country the medical man is compelled perforce to live under unnatural conditions; he is out in all weathers and at all times; and it may be truly said that a busy physician can hardly call an hour his own. Then he is constantly exposed to infection, and a large part of his life is spent in the depressing and devitalizing atmosphere of the sickroom. It will, therefore, be no matter for surprise to learn that, excepting artists, the largest number of suicides are recorded among members of the medical profession. Insanity, also, has wrecked the minds of many brilliant physicians.

Politics, according to Dr. Arlidge, is one of the most healthy of occupations. This fact has been proved time and again—Gladstone, Beaconsfield, Bismarck and Thiers are conspicuous examples of the truth of this statement. Great brain workers are notoriously long lived, and among literary men, scientists, professors, and teachers, the mortality is far lower than among the industrial classes. Therefore, Dr. Arlidge holds that activity of the mind, if bent in the right direction, has more to do with the health of the body than muscular exertion, but he thinks that a judicious combination of both forms of exercise brings about the ideal healthy condition.

Employers of labor are especially subject to heart affections. Nervous complaints come second, apoplexy third, and consumption fourth. The commercial traveler is a man who seldom reaches the allotted term of years. Irregular hours, too much drinking and smoking, and poorly cooked food are the factors that tend to bring his existence to an untimely end. Policemen are, as a class, very healthy and live to an advanced age, due to the fact that they are chosen for their soundness, and that their life is largely spent in the open air.

Rheumatism has been found to be the affection with which the policeman is chiefly troubled. The mail-carrier is healthy on account of his outdoor life, but for the same reason is peculiarly subject to rheumatism. The miner, notwithstanding that for eight hours of the twenty-four he is working cramped in a coal pit, shut out from the sun and in an atmosphere thickly impregnated with coal dust, is, contrary to preconceived notions, a healthy man and usually lives to a green old age.—Medical Record.

BOVINE TUBERCULOSIS AND THAT OF MAN.

There has been a great deal of discussion regarding the question of milk of infected cows as affecting the health of human beings. Prof. H. W. Conn, in the Bulletin of Storrs Agricultural Experiment Station, refers to two claims made by Prof. Koch, at the Tuberculosis Congress, in London, during the summer of 1901. The claims are:

1. The bacillus which produces the bovine tuberculosis and that which causes human tuberculosis are different from each other.

2. This disease in cattle is so different from the similar disease in man that it is very rarely transmitted from animal to man. The danger to mankind from the use of milk and flesh of tuberculous animals is, therefore, extremely slight.

Prof. Conn says: These two claims were quite at variance with the belief common among bacteriologists and physicians in the last few years. The address was received with much opposition and a large amount of discussion has followed. The discussion has been the means of stimulating many additional experiments and bringing to light many facts bearing upon the question at issue. The debate has been constant since the delivery of the paper by Prof. Koch. Nearly all of those who have written upon the subject have taken a position which is in a measure corroborative and in a measure opposed to the position assumed by Prof. Koch. The attitude which the scientific press has adopted in the discussions of the last few months may be summarized as follows:

1. The first claim of Prof. Koch, namely, that there is a difference between the bacilli producing the disease in animals and those producing it in man, is generally admitted to be substantiated. The difference in the two organisms is shown in several respects, the most important being that the bacillus of tuberculosis in man does not so readily produce tuberculosis in cattle, and is, therefore, with cattle, apparently less virulent than the bacillus of bovine tuberculosis. It is not yet settled whether this difference is anything more than a slight difference in variety, which the same species of bacillus assumes when growing in two different localities; but the majority appear to believe that the differences between the two bacilli are not very great, and not sufficient to warrant a conclusion that they are different species. The more common view is that they are the same organism, slightly modified by the growth in different localities.

2. The second claim, namely, that tuberculosis cannot be transmitted from cattle to men, is emphatically denied. A number of instances have been brought to light in the last few months, where the evidence of direct transmission from animal to man is so strong as to be hardly questionable. Most bacteriologists at the present time are positive in their assertion that the disease is communicable from animals to man.

3. The suggestions advanced by Prof. Koch, and the evidence that has been brought out previously and subsequently to the recent discussion has, however, rendered it quite evident that the flesh and milk of tuberculous animals are not to be looked upon as common sources of human tuberculosis. There are quite strong reasons for believing that, as far as adults are concerned, the disease in man is rarely derived from cattle. There is more reason for believing that young children, feeding chiefly upon cows' milk, are frequently infected with tuberculosis from this source. It is certainly a fact that there is considerable tuberculosis among young children, and it is generally assumed that the milk of tuberculous cattle is a large source of such infection. The evidence for this claim is not very decisive, however, and although it appears to receive the approbation of the majority of bacteriologists, it is not admitted by all that there is, even among young children, any considerable amount of this disease attributable to milk.

Tuberculosis in Cattle and Swine.

Hon. Frank H. Mason, U. S. Consul-General to Berlin, gives some interesting statistics respecting the increase of tuberculosis among cattle and swine in Germany.

From the report given it appears that of three and a half million cattle slaughtered in the years 1898, 1899 and 1900, nearly 540,000 (more than one-seventh), were found to be infected with tuberculosis. The number of infected cattle increased from 14.4 per cent. in 1898 to 15 per cent. in 1900. Of eleven million hogs slaughtered in the same time, 250,000 were found to be infected. There was also found to be an increase in the proportion of infected hogs. The situation is not quite so bad in this country, but this dreadful infection is steadily spreading among the domestic animals.

Removal of Ear Wax.

Hardened wax in the external ear can often be removed readily by injections of warm water and soap, soda or ammonia. Many cases resist this, and require the softening effects of glycerine or sweet oil for a day or two before syringing. Do not bother with these long processes, but use a half-strength solution of hydrogen dioxide in the ear for about five or ten minutes.

This will disintegrate the most obstinate plugs, and they can be removed with very little syringing. Do not use too much force with the syringe. Wipe the ear perfectly dry with absorbent cotton and apply petrolatum. Wear a small plug of cotton in the ear for one day after removal. The purpose of the cotton is to prevent sudden thermal changes.

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LORD KELVIN'S VISIT.

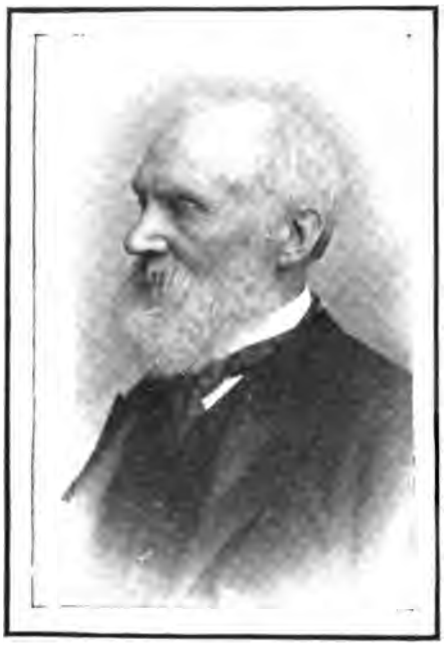
The United States has been highly honored by the recent visit of Lord Kelvin.

His contributions to the sum of human knowledge have been so numerous and varied that he may go down in history as the greatest scientist of the nineteenth century, which has been a period particularly rich in scientific achievement, and characterized by many great names. At the ripe old age of seventy-eight, Lord Kelvin is still a student, striving to solve some of the many problems that natural philosophy presents to the human mind.

Lord and Lady Kelvin arrived in New York on April 19th, and on the 25th attended a reception held in their honor, at Columbia University, by the American Institute of Electrical Engineers, assisted by the officers of the university, the National Academy of Science, the American Association for the Advancement of Science, the Astrophysical Society, and the New York Academy of Science.

The reception was held in the gymnasium of the university; the platform and body of the hall were thronged with men and women eager to shake the hand of the venerable man of science. After speeches of welcome were made by several of the prominent men present, Lord Kelvin stepped to the front of the platform and acknowledged the cordial reception. He did not think that wireless telegraphy would in any way conflict with the submarine cable, but would rather be supplemental to it, as the telephone has proven to be to the telegraph. Speaking along these lines, he said that science has advanced greatly during recent years in all branches, and one of its greatest achievements is that of Marconi and wireless telegraphy. In closing, Lord Kelvin referred to the "harnessing" of Niagara and the wonderful possibilities developed by the electrical transmission of this great power. He said that beautiful as is that wonderful work of nature, it would be far more beautiful still if these waters fell upon turbine wheels, every one of which was turning the wheels of industry.

William Thomson, now Lord Kelvin, was born in Belfast, Ireland, on June 26, 1824, but from the age of eight years, he has lived continuously in Glasgow, Scotland. At the age of 22, he was appointed professor of natural philosophy in Glasgow University, and continued to hold the chair for 53 years, despite numerous offers to remove to Cambridge and elsewhere.


Elec. Review. LORD KELVIN.

Lord Kelvin's mind has been unusually prolific of investigations in all branches of physics, but especially in heat, electricity, and dynamics. He determined the law of velocity of electric signals through long submarine cables, and invented the mirror-galvanometer by which these signals could be easily read. For this improvement in submarine cabling he was Knighted in 1866. This is Lord Kelvin's fourth visit to the United States, the former visits occurring in 1876, 1884, and in 1897. In the latter named year he had his first opportunity of seeing the great power plant at Niagara Falls.

* * *

THE VOLCANIC ERUPTION AT MARTINIQUE.

The disaster of May 8th, on the island of the French West Indies, where, according to reports, about 30,000 lives were lost, forcibly reminds us how little is known of the exact cause of these phenomena. According to the best authorities, about 12,000 people perished in the ruins of Pompeii, and granting this to be true, the eruption of Mount Pelee at St. Pierre is the most disasterous volcanic eruption in history.

Complete and accurate reports have not yet been received, but from what has been learned, the eruption was of the explosion type, similar to Vesuvius, but differs in nature of the matter ejected. In the case of Vesuvius, the explosion was great enough to powder the lava. But in this case, immense masses of lava were blown out. To this white-hot lava can be ascribed the destructive fire in the city, and the surrounding country. The report of a rain of fire was simply this white-hot lava.

The sudden access of a body of water to the lava reservoir is the only explanation worthy of the present evidence. The eruption is peculiar for the reason that immense masses of lava were ejected along with the lava stream, and that comparatively little volcanic dust was noticed.

The scientific departments of the Government have already sent men from the Geological Survey, and we may later expect full and authentic reports.

* * *

THE HEAVENS FOR JUNE.

BY PROF. MALCOLM McNEILL.

The month of June, 1902, is not an especially interesting one as far as predictable astronomical events are concerned. The constellations are the same as they have been for centuries past and will be for centuries to come. The planets for the most part can be seen only late at night or in the early morning twilight. Some new star may burst out into brilliance like the recent star in Perseus, but such phenomena are not yet in the category of predictable events. Some wandering comet may sweep in near the sun or near the earth, and give us a fine display; but the very bright comets are almost without exception either new visitors, or are traveling in such elongated orbits that their periods are only roughly known and their returns cannot be accurately predicted.

The constellations,—Cassiopeia is low down east of the north point. Cygnus and Lyra are in the northeast about half way up toward the zenith. Hercules and Corona are still higher and Bootes is in the zenith. Aquila is low down in the east. Scorpio is the only prominent constellation in the southeast and it is low down near the horizon. Virgo and Leo are the most noticeable constellations in the southwest, the Sickle, the principal group of the latter, being nearly due west. Gemini is setting in the northwest with Auriga farther north and Ursa Major high up in the same quarter.

Phases of the Moon, Eastern time:

New Moon,	June	6,	1 h. 11 m. A.M.
First Quarter,	"	12,	6 h. 54 m. P.M.
Full Moon,	"	20,	9 h. 16 m. P.M.
Last Quarter,	"	28,	4 h. 52 m. P.M.

The sun reaches the solstice and summer begins at 4 A.M., June 22.

Mercury is still an evening star at the beginning of the month, setting more than an hour and a half after sunset. It passed its greatest east elongation on May 28, and has now begun to swing back toward the sun. On June 10, the planet still remains above the horizon more than an hour after the sun has gone down, but after that the approach is very rapid and conjunction occurs on June 23. By the end of the month the planet is well out toward west elongation; but it is too far south of the sun to be seen as a morning star.

Venus is a morning star, and rises about two hours before sunrise throughout the month. It is moving rapidly eastward among the stars through the constellation Aries into Taurus, and its apparent distance from the sun diminishes about 3° during June, but its more rapid northward motion causes an increase of about twenty minutes in the interval between the rising of the planet and that of the sun.

Mars is also a morning star about half way between Venus and the sun. By the end of the month it rises an hour and a half before sunrise, but as it is at about its greatest distance from the earth, and consequently at its minimum brightness it will not be at all easy to see.

Jupiter rises before midnight on June 1 and before 10 P.M. on June 30. It is therefore getting into position where it may be seen late in the evening. It is in the constellation Capricorn, and moves slowly eastward until June 6. During the rest of the month it moves about 1° to the westward.

Saturn is in the extreme western part of the same constellation, and rises an hour earlier than Jupiter. It is also retrograding and moves a little less than 2° westward during the month. It therefore slightly increases its apparent distance from Jupiter. During the following three or four months the apparent distance between the planets will diminish several degrees, but at the time of nearest approach they will be probably about 17° apart.

Uranus comes to opposition with the sun on June 20, and is consequently above the horizon practically the entire night throughout the month. It is in the southern extension of Ophiuchus, between Scorpio and Sagittarius and moves westward about one degree during the month. It shows itself to the naked eye as a star of the sixth magnitude and may be made out by a good eye on a clear moonless night; but it is not easily identified unless one knows just where to look for it. There is no bright star very near. It is nearly on the line and about half way between Beta Scorpii, the star marking the northern claw of the Scorpion, and Lambda Sagittarii, the star in the end of the handle of the "Milk Dipper." The small third magnitude star Theta Ophiuchi is about 2° south of Uranus, and on June 1 about 13′ east. The last distance increases to about 1° 30′ during the month. There are two fifth magnitude stars southwest and northeast of the brighter one. The planet is decidedly fainter than either of them.

Neptune is close to the sun throughout the month and comes to conjunction on June 23.

Correspondence

Insects and Electric Lights.

Editor POPULAR SCIENCE NEWS:

Wishing to identify some of the flies, beetles, moths and other insects attracted by the arc lights on the streets of Philadelphia, on a moderately warm night, early in September, I hired two stout boys to assist me in the capture. They stood on step-ladders on opposite sides of a light and swept the "bugs," as they called them, into their long-handled nets. When I saw that a boy had taken a sufficient number, he turned his net into a position that prevented the escape of the insects and passed the handle down to me. After a careful inspection of the swarming occupants of the nets, I secured in my cyanide bottle such specimens as I desired to preserve for my cabinet, and either allowed the rest to escape or killed such as I knew to be injurious to vegetation. After I examined the other boy's captures, we carried our step-ladders and nets to other arc lamps.

The experiment was attended with some instructive results. Among the neuropterous insects which I allowed to escape were not a few dayflies, or Ephemerids, of the species that hover over water, and in most cases live for only a few hours of a single day. It seems, however, that some of their number prolong their brief lives to dance around the attractive lights, but it is probable that all such die before the return of another day. Still, I have, by way of experiment, kept a few of these flies alive for a week in an insect cage.

Many specimens of the lace-winged Golden-eye (Chrysopa oculata), were also among the captures. This fly (also belonging to the Neuroptera) I always allowed to escape, both on account of its disgusting odor, and because I recognized it as one of man's useful friends. Its larva is an active destroyer of the green lice which infest many of our most valuable plants.

Among the true bugs (Hemiptera) found in the nets, were two aspirants to the title of "Kissing Bug," about which there has been some excitement in recent summers. One of these is the giant water bug, Belostoma Americanum, now coming to be known as the "Electric Light Bug," a clumsy but harmless fellow. The other is a more savage biter, though not at all venomous, the Masked Bedbug Hunter (Reduvius personatus). His strong jaws have been known to pierce the human skin. I caught, also, a few specimens of the large Ground Beetle (Harpalus Pennsylvanicus), another candidate for "Kissing Bug" fame.

The order Lepidoptera furnished the greater part of my captures. Among these moths I noticed the parent of the corn-ear worm (Heliothis armiger), whose disgusting form pollutes nearly every ear of sugar corn offered in our markets for table use. Another was the parent moth of the noxious army worm (Leucania unipuncta), and of the fall army worm (Laphygma frugiperda). The cutworm species were also in evidence, but the tomato worm and garden webworm moths were more rare. Injurious and harmless species are about equally abundant.

C. E. AARON, A.M.

The Best Schools.

Editor POPULAR SCIENCE NEWS:

The best schools are those that educate the leaders in the world's work in every sphere of action, from the master thinkers and writers, inventors and discoverers, statesmen and generals, etc., down to the foremen and overseers, master mechanics and common tradesmen, farmers, and all in every walk of life. The schools that produce the Marco Polos, the Columbuses, the Gutenbergs, the Napoleons, the Jeffersons, the Lincolns and the Edisons, prove by their products that they are the best in the world, whatever high-sounding titles other institutions may have, that fail, however, to produce the equals of those here enumerated.

Lincoln, like Horace Greeley, attended school for less than a year altogether; each obtained the balance of his education in the "world school." Shakespeare got as far as the grammar school of Stratford-on-Avon, his native town; the rest he learned on the stage in London and elsewhere.

Thomas Jefferson and Martin Luther received each such a college training as thousands of others did; but what made them the master spirits of their times was what they acquired by mingling with the common people, studying their wants and espousing their cause. So Marco Polo, Christopher Columbus, and Benjamin Franklin received their training in the general world school. The same with Paul of Tarsus, the twelve apostles, and their master, Jesus of Nazareth, as well as scores of like heroes and martyrs of science and religion, in all ages. We behold the same results on the female side of humanity in Queen Isabella, Madame de Stael, Harriet Beecher Stowe, and hosts of others who have been among the world's greatest benefactors.

More than thirty years ago, immediately after having exchanged the paths of the student for those of the teacher, I formed the acquaintance of a rural philosopher who called my attention to the fact that, though the cities everywhere and at all times had the long school terms, while country boys received but a few months of instruction, yet the cities did not fill their own demands for professional and business men, and then turn a surplus out into the country to fill the most important and responsible positions there, as one would naturally imagine; but that on the contrary, the city schools never succeeded in producing suitable material to supply the demands within their own borders; and that on careful examination one would find that a very large percentage of their foremost doctors, ministers, teachers and tradesmen had been poor country boys with very limited school advantages, while those reared and educated in the cities were generally very conspicuous for their absence in the foremost positions.

I was profoundly impressed when, on examination of the facts, I discovered what an amount of grim truth there was in the rural sage's statements. On studying the biographies of the master spirits of every country and age, it becomes painfully evident how utterly the schools everywhere and at all times failed to produce the chief actors on the world's stage. We have a model of ten thousand similar examples in the great struggle in the national convention at Chicago in 1860, when Abraham Lincoln, the rail splitter, who got but twelve months' schooling in all his boyhood days, was preferred to the fine college-bred William H. Seward. Both were unquestionably of the noblest and best men; but who would undertake to-day to dispute the wisdom of the choice of that convention? Would the people have had the same confidence in Seward at the head, as they had in Lincoln, the backwoodsman?

There is evidently something in our systems of education that is somehow fatally injurious to the proper devolopment of the bodies, hearts and minds of those children who attend school for too large a portion of the year. Are their spirits broken and their intellects clouded while they are oppressed by a species of imprisonment every day at school? A certain prominent educator, Prof. R. H. Thurston, of Cornell University, in an able article recently published in The Popular Science Monthly, predicts that in another generation the self-made man will cut less of a figure, and that the college man will lead in the world's work. We believe that history will continue to repeat itself—that Pestalozzi and his educational father, after whom was named the son, were right, and that, unless there is a far more radical change in educational instrumentalities effected by devoting the greater part of each day to practical work, to play and free exercise, and a smaller porton to literary pursuits, the future will, like the past, continue to find its fittest materials for great results among those who have spent least of their time at school.

A free discussion of this subject would undoubtedly be very interesting to our people. They would be happy to see every proposition and fact advanced also by the opposing side, to be examined in the light of history and of common sense. No writer whose sole concern is the discovery and advancement of truth, should ever object to a fair, honorable and respectful discussion. ORION.

Spring Migration of Birds.

Editor POPULAR SCIENCE NEWS:

It is not my intention to propound a new theory of migration, or to expound any old one, but merely to follow out the unambitious design of publishing a few observations upon the coming and going of some of our commonest birds, with the wish that the data may be of use to others, who are investigating scientifically the "mysterious instinct" which is said by the enthusiast and the poet to show infallibly the bird of passage his

"Way along the pathless coast,
The desert and illimitable air,
Lone wandering but not lost."

My observations were made mainly in Knox Co., Illinois; but many notes were taken in Mower and Fillmore Counties, Minnesota; and some few in Uinta Co., Utah, and Shannon Co., S. Dakota.

Let us begin with the American robin. In 1894, the first of these birds was seen on March 3 In 1895 a "straggler" was seen on January 3 (illustrating variability in the "unerring instinct"). The first regular migrant of that year was observed March 26; in 1896, March 9; in 1897, March 8: the foregoing observations were made in Knox Co., Ill. In S. Minnesota, in 1898, Mar. 14 was noted as date of arrival, but a local periodical states that they were seen before this. They became common on the 19th.

In 1899, the first robin was seen by me on April 5, although one was reported as having been seen about a week before. They became common on the 8th: locality, Fillmore Co., Minn. In 1900, in Illinois, first date, March 7—common, 11th; in 1901, in N. E. Utah, I did not hear or see any of these birds until April 7th. In 1902, on my old observing ground in Illinois, three robins were seen by a friend on March 10; in Shannon Co., S. Dakota, I first saw this species on the 22d; common thereafter.

The common bluebird next demands our attention. My notes on this species are meagre, owing to its scarcity and shyness of late years. In 1894, this bird was observed first on March 2; did not become abundant, and in 1895 was not seen until late, and then only in wooded districts. In 1896, February 28 was the date of arrival; in 1897, March 10—a local newspaper says before this. All the foregoing refer to Illinois. In 1898 (S. Minn.), the date of arrival as recorded in my note-book was March 10, and a reliable observer stated having seen one of these birds the previous day. They were present in normal numbers about the 17th. In 1900, in Illinois, a number of bluebirds were seen on March 31 and April 1. I fancied that I heard their call on April 7, but was not certain.

In 1894, the first meadow lark is recorded on March 5; in 1895, March 19; in 1896, March 6; in 1897, March 11. (Observations in Illinois). In 1898, the western meadow lark was first seen by me on March 27, in S. Minn., Mower Co. In 1899, Fillmore Co., Minn., a trustworthy observer saw one of these birds on March 26th.

They were common from the first day of April, that year. In 1900, in Illinois, I have recorded one meadow lark as seen on March 11, and their next mention comes under March 29, when "I saw large numbers of meadow larks singing cheerily in the midst of a severe ice-storm." In N. E. Utah, in 1901, I saw the western meadow lark on March 22; in 1902, in S. Dakota, March 22. In both cases they became common immediately.

The red-winged starling's first date, 1894, was March 19; 1895, March 30; 1897, April 28; 1899 (in S. Minn.), April 8. As this bird is most common in marshy localities, my opportunities to observe were not of the best.

Dates of arrival as recorded in the case of the chewink: in 1894, March 19; 1895, April 14; 1896, April 5; 1897, April 3—common immediately; 1898 (in S. Minn.), May 5. The chewink skulks unseen in thickets, and sometimes will long remain near a dwelling, unsuspected; so the few dates given are of little value.

The cowbird: 1894, March 31; 1895, April 3; 1896, April 18; 1897, April 8—common immediately. (Observations in Illinois.)

Dates of kildeer plover: 1894, March 14; 1895, April 12; 1896, April 11; 1899 (in S. Minn.), April 9; 1900 (Illinois), March 11; 1901 (Utah), kildeers were seen on April 1, becoming common immediately; 1902 (S. Dak.), several kildeers were seen on March 22—common thereafter.

The turtledove: 1894, April 8; 1895, April 1. These birds are not strictly migratory; in 1896, February 15, I saw a turtledove in a thicket in Knox Co., Ills.; and in 1897, January 17, I saw a pair, and January 29, a dozen of these pigeons, at points not far from the place of the observation of February, 1896. In 1898 (S. Minn.), I saw a turtledove on March 20.

The date of arrival of the brown thrush in 1894 was April 17; in 1895, April 26; in 1896, April 13; in 1897, April 14—common on 22; in 1898, I did not observe any until May 4 (S. Minn.)—they became common immediately. In 1900, in Illinois, I saw a brown thrush on the 16th, and another on the 18th of April.

The chimney swallow, or swift, in 1894, was observed for the first time on April 17; 1895, April 28; 1896, May 1; 1897, May 15; 1898 (S. Minn.), April 30—common immediately; 1900, in Illinois, May 6—common thereafter.

Dates of purple martin: 1894, April 18; 1895, April 10; 1896, April 13—common after being first seen; 1897, March 27, one individual—not common immediately; 1898 (S. Minn.), April 16—common thereafter; 1899 (same region), April 25—common after that date; in 1900, common in Illinois from April 30.

The kingbird: 1894, April 30; 1895,

April 28; 1896, April 20; 1897, April 25—common thereafter; in S. Minn., in 1898, May 8—common from date—and in 1899, April 29; in 1900, in Illinois, April 23—common from the 27th.

A record of this kind, of itself, amounts not to a great deal, perhaps; but a dozen or so such records would bring out many an interesting fact, when compared one with another. The dates here given are not presumed to be the actual dates of arrival, but merely show the time, kept practically by a single observer, when the birds were seen first in the given localities. In some cases, the date when the bird became common is given, and such records are of most worth. Species which are not to be found uniformly dispersed over a large area regardless of physical conditions, but are confined to deep woods, or swamps, or thickets, are the most difficult to observe as to their arrival and departure. When, like the robin and the meadowlark, they are spread over the general face of the country, then we can expect to arrive at some definite conclusion with respect to their time of coming and going.

HERBERT TULLSEN.

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Poetry of the Diamond.

Editor POPULAR SCIENCE NEWS:

Noticing what is said of the poetry of minerals in your April number of the POPULAR SCIENCE NEWS, I send you a copy of verses, long dear to me, from the hand of a personal friend, who seems to me to be the very embodiment of the poetry of science.

THE DIAMOND.

Star of the flowers, and flower of the stars,
And earth of the earth, art thou!
And darkness hath battles, and light hath wars
That pass in the beautiful brow.

The eye of the ground thus was planted by Heaven,
And the dust was new wed to the sun:
And the monarch went forth: and the earth star was given
That should back to the Heaven-star run.

So in all things it is; the first origin lives,
And loses his life out to his flock;
And in dust, and in matter, and nature, He gives
The spirit's last spark from the rock.

I greatly enjoy reading the news you furnish us, and wish I had time to send you oft suggested contributions from my pen.

That crystals grow is certainly true; but to say that a crystal—even a diamond,—is as much alive as a man, seems to me unscientific, to say the least. To say that a crystal is as much alive as a vegetable, would still be too much. To say that it is alive at all, is questionable. To say that crystals *grow*, is perhaps enough to make everything concerning this formation and existence more luminous than hitherto.

LOUISE M. FULLER.

Questions and Answers

QUESTIONS NOT ANSWERED.

Answers are solicited, especially for all questions so far without replies. Questions will appear but twice, successively.

Will the inquirer who sent in a query about the "Sun is O," please repeat and make the question clearer?

362. A Silhouette Party. How is this arranged and conducted? I have seen it mentioned. J. KNIGHT.

366. Deterioration of Coal. Will some one kindly inform the readers of POPULAR SCIENCE NEWS how much coal will deteriorate by being stored outdoors more than if it were under cover where there is no rain for six months of the year? J. V.

367. Meerschaum Pipe. What is the best and quickest method of coloring a meerschaum pipe? R. G. PAINE.

368. Sailing of the Buzzard. How—upon what principle—does the Buzzard (Cathartes aura) sail? He does sail, without any discoverable wing-motion, in any direction he chooses, apparently independent of any but a very strong wind, for hours at a time; rising, descending, turning, going ahead, at his pleasure, without any discernable motive power whatever.

To solve this problem, I conceive, is to take a long step in the direction of the solution of that other problem, aerial navigation. F. S. MATTESON.

369. Safety Matches. Knowing that a great many vexatious questions are satisfactorily answered through your columns, I should like to know of what material the so-called safety matches are made. There seems to be a peculiar chemical affinity between the head of the match and the material on the outside of the box; any amount of scratching on any other substance will not ignite the match, and I have often wondered as to the composition of the two materials used. Can any one tell the ingredients and the formula for mixing same? The slightest touch on the box will ignite the match, while they may be dropped on the floor or any other combustible surface without danger of their becoming ignited if stepped upon. I have never heard of an explanation or seen any literature on the subject, and believe information on this subject would be of general interest. SMOKER.

370. Size of Telescopes. What is the size of the largest telescopes ever constructed? P. P.

371. A Cat's Eye. What is the microscopic structure of a cat's eye, whereby it shines with a greenish light in the dark? P. P.

372. Typewriter Ribbon. Can any of your readers give me directions for making typewriter ribbon? AMARIAH.

373. Cold in the Head. Many things are recommended for this, and also for chronic nasal catarrh, but I would like to hear from any one who has found an effectual cure that is not a patent medicine. B.

374. Substance of Comets. One theory is that comets are made up of meteorites. If so, how is it that a star can be seen through the nucleus as bright as usual? A. E. ROLITE.

375. Excessive Blooming. Can any one tell me what advantage it is to the Judas Tree to be clothed with flowers on every branch, from base to tip, as it is now in May, in the instance of a young specimen on my front lawn? What struggle for existence is helped by this excess of flowers? SUBURB.

376. Substitute for Quinine. Is there any substitute for quinine in treating malarial fever? That remedy does not agree with me. L. F. G.

377. Swelling of Fingers. Why do the fingers swell in the summer time to a thickness greater than that in the winter? During the winter season my ring is frequently so loose as to be annoying, but just so soon as the warm weather begins, it becomes very tight, sometimes uncomfortably so. R. I.

378. Individuals Affecting Flowers. It is a curious fact that cut flowers wither and die sooner when worn by some people than by others. This has been noted by the writer. Florists are cognizant of this peculiar condition, and frequently have complaints made by their fair patrons that the flowers, though guaranteed fresh, "droop after being worn only one evening." Others having flowers taken from the same lot, may have kept them fresh for a week. Does the vitality of the person wearing the flower produce the effect? If so, how? If not, what is the cause? This is a strange thing, and may be noticed by anybody. P. S.

ANSWERS.

240. Oxygen. The inquirer is perhaps aware that the old way in chemical laboratories is to derive oxygen by heating potassium chlorate (best if mixed with a little pure powdered black oxide of manganese, as less heat is required) in a flask over a lamp. But, the operator should have practice in a laboratory as the chlorate is subject to explosion. This, and also the manganese dioxide give up readily their abundant oxygen. CHEMIST.

309. Jerking Cars. This jerking motion of which L. D. complains, is not so much a question of mechanics, as of judgement of the engineer or motorman. This is particularly noticeable in street railways operated by moving cable, as it is difficult to construct a gripping device that will enable a heavily loaded car to start from a standstill to the speed of the cable without some slipping. As the cable system is rapidly becoming superseded by electricity, in which the current is fed to motors under the car, "jerking" is entirely the fault of recklessness on the part of the motorman, who either puts on the full current or the brake, too suddenly. In the case of steam railways, the sudden stopping or starting is due to poor judgement of the engineer. MECHANIC.

355. **Fireproofing Wood.** There are various methods, but a ready one is cheap, namely, applying with whitewash brush a strong solution of fresh potash or even lime,—with care not to wet the hands. This is only for rough work, such as framing, to retard fire until extinguished.

OBSERVER.

356. **Heating Water in Quantity.** For attachment to a kitchen cylinder boiler, there is a "gas water-back," which will heat enough for kitchen purposes or for bathing, in a few minutes. It cost me eight dollars. HOUSEHOLDER.

356. **Heating Water in Quantity.** If you have gas, there is a so-called gas water-back that can be fixed to range boiler. It will heat the boiler very quickly S.

358. **The English Sparrow vs. Other Birds.** At the Arnold Arboretum, near Boston, Mr. Jackson Dawson has a kindly regard for the abused little bird and denies the alleged driving out of other birds. He says: "The English sparrow is more sinned against than sinning. They say he drives away the singing birds. I don't believe it. Certainly not in the arboretum, where the sparrows, robins, thrushes, bluebirds, quail, and all birds work in perfect harmony with one another, all doing their particular part. While he polices the roadway he also does his share in the grub business. I often see him tackling large grubs and even caterpillars of large size. I like to see this hardy little fellow who stays with us winter and summer amid storm and sunshine, always seemingly contented with his lot and doing his part of the work. He reminds me of those hardy pioneers who first came to this country and had the perseverance and pluck to winter out the storms and hardships and build up a nation like no other on earth. They came to stay.

W. M. G.

359. **Incandescent Lamps.** The consumption of current increases after 300 hours' burning: therefore the resistance increases. The filament thickens by the deposit of carbon by electricity upon the filament. This helps to lower the candle power, and when the lamp gets hot expansion takes place, and a certain amount of air gets in between glass and wire. This in time lowers the vacuum, and, of course, the candle power. So says A. Blanks in Eng. Mechanic. Another says that the current consumed by incandescent lamps generally increases for the first hundred hours' use, and then steadily declines till the finish. This is due to the carbon being wasted away, increasing the resistance. The cause of wasting of the carbon is presumably evaporation, just as water evaporates when heated, although the temperature may never reach boiling point.

CONSULTANT.

360. **Tarnished Brass-work.** The method of cleaning and relacquering is too long and complicated for home work. Better regild in the way one follows in renewing picture frames. L. B.

361. **The Red Spot on Jupiter.** It is permanent but not stationary. No satisfactory explanation have I seen. ASTER.

361. **The Red Spot on Jupiter.** When the red spot on the planet Jupiter is observed so as to determine the period of its rotation it is found that this period is subject to a regular change. Its rotation period is therefore growing longer, while the rotation period of the planet itself, in the latitude of the spot, is a constant quantity. Since 1891, the spot, like a huge floating island, has traversed something like three-fourths of the circumference of the planet in a retrograde direction. At the same time the spot has slowly increased in length. It was, for example, about 32 degrees long in 1897 and 37 degrees long in 1896. The rotation of the planet is not the same in different latitudes.

According to Prof. Bredichin, the layer of quickest rotation is in the middle latitudes, not near the equator. This conclusion is derived from the observation of the relatively small cloud-like masses lying in the upper regions of the planet's atmosphere. It is very doubtful whether the red spot is to be considered as a cloud-like mass. It seems to lie in the deeper levels of the Jovian atmosphere, as is indicated by appearances when it is near the borders of the planet; and small, bright objects are often seen above it and its surface is frequently veiled by a thin, cloud-like screen. Prof. Bredichin considers it as a solid mass sliding over the liquid surface of the planet among the lower layers of the vaporous atmosphere. It is very improbable that the red spot is a sea of glowing lava, and more likely that it is a semi-solid crust of some sort.

SUN.

362. **A Silhouette Party.** Fasten large sheets of paper to the wall; place the sitter close to it, in a dimly lighted room, with a small lamp near, on the same level as head; with a long-handled brush and black ink, or any other color, brush all around inside of and up to outline of shadow; then fill in the uncolored space after the sitter steps away. Various headgear, bouquets and attitudes, will vary the interest. Of course, a pencil can be used to outline. AMATEUR.

363. **Hydrogen.** There is no more hydrogen than water in ammonium hydroxid (NH_4OH). Hydrogen may be obtained from the action of hydrochloric acid or sulphuric acid on zinc or iron. Also water (H_2O) may be deprived of its oxygen by passing steam over hot carbon, and hydrogen be thus liberated. Zinc dust heated with slaked lime, liberates hydrogen.

GRINNELL BURT.

363. **Hydrogen.** There are many substances which contain more hydrogen in proportion to the other elements, besides water; e. g., ammonia, gasoline and kerosene, and many of the hydrocarbons of the "marsh gas" series, besides several gases, such as phosphorus and arsenic hydrides. Although an easy way to generate hydrogen is by electrolysis, the most common laboratory method is by the addition of dilute sulphuric or muriatic acid to zinc. There are any number of methods, but these are the most common.

THOS. M. MUIR.

363. **Hydrogen.** Any good chemistry will give several ways of making hydrogen, most of them quicker and more practical than electrolysis.

C. WILLIAM GROSS.

364. **Bleached Photographs.** That depends on how they were bleached. If they are the regular "bleached photo," i. e, bleached with a mercury salt, they may be revived with a weak solution of hypo in water, but they must be washed well to get rid of the hypo. If they are bleached from age, the character of the paper used must determine the treatment.

C. WILLIAM GROSS.

365. **Luminous Paint.** In POPULAR SCIENCE NEWS for July, 1899, I gave a formula for luminous paint in answer to question 43. The paint can be used either indoors or out. C. WILLIAM GROSS.

368. **Sailing of the Buzzard.** The only supposition is that it is on the principle of the aeroplane,—one of the machines for aerial navigation,—that is, as I understand it, like the kite, the bird's momentum taking the place of string. E. K.

369. **Safety Matches.** The chemical materials separately do not ignite by friction. One formula is as follows: Dip splints into mixture of chlorate potash 6, sulphide antimony 2 to 3, glue weighed dry 1. Paste for rubbing surface: Amorphous phosphorous 10, oxide manganese or sulphate antimony 8, glue weighed dry 3 to 6. Thoroughly mix the ingredients; the chlorate not to be mixed in dry state with other materials, but first with glue dissolved in warm water. Spread on with brush or spatula. R. PARK.

Electrical Experts to Meet.

Messrs. Marconi, Tesla and Edison are expected to be guests of the American Institute of Electrical Engineers, which will hold a meeting at Great Barrington, June 18 to 21. Mr. Marconi, it is stated, will for the first time make inland long distance wireless telegraph tests from some hill top in Lenox, or White Hill in Egremont, near Great Barrington.

The test will be on the second day of the convention of the engineers.

The Marconi station in New York City will be on Mount Morris, and the experiment will be personally conducted by Mr. Marconi. The electrical engineers will visit the Stanley shops in Pittsfield, and the City Council has voted to entertain them. It is expected that over 300 experts will attend the covention.

BOOK NOTICES.

Animal Activities. Nathaniel S. French, Ph.D. 262 pp. Cloth, $1.20. Longmans, Green & Co, This book is, as its sub-title sets forth, a first book on zoology, and will doubtless prove to be of interest and value to students in this science. It will also make a place for itself as a convenient book of reference, for the subject is handled in such a clear and logical manner that the knowledge it contains is readily available. The book is well printed on good paper and is profusely illustrated.

The Study of Mathematics. By Augustus De Morgan. Second reprint edition. Cloth; pp. 288. Open Court Pub. Co., Chicago. The intention of the work is to supply to students, particularly those who have not the advantages of a university education, the many perplexing points not fully explained in the ordinary text-book. The object of the author has been to notice particularly several points in the principles of algebra and geometry, which have not obtained their due importance in many elementary works on these sciences. A useful book to students along these lines.

The Philosophy of the Christian Religion. By A. M. Fairbairn, D.D., LL.D., Principal of Mansfield College, Oxford. The Macmillan Co. This book may be described as an attempt to do two things: First, to explain religion through nature and man; and, secondly, to construe Christianity through religion. The author conceives religion to be a joint product of the mind within man and the nature around him, the mind being the source of the ideas which constitute its soul, the nature around determining the usages and customs which build up its body. He does not think, therefore, that any one of its special forms can be explained without the local nature which begot and shaped it, or that its general being can be resolved and construed without the reason or thought which is common to the race. He sees in religion the greatest of all man's unconscious creations, and the most potent of the means which the past, while it was still a living present, formed for the making of the man and the times that were yet to be.

The Science of Mechanics. By Ernst Mack. Translated from the German by T. J. McCormack. Second revised and enlarged edition. Pp. 605. 259 cuts and illustrations. Open Court Pub. Co., Chicago. A work going deeply into the principles of mathematics as applied to mechanics, decidedly a book for advanced students. The author considers the achievements of Galileo, Huygens, Newton, and other famous mathematicians, giving numerous examples of the principles laid down by each. A complete and painstaking work.

The Riddle of the Universe, by Ernest Haeckel. A Review by Rev. William Russell Scarritt, D.D., Minister of St. Peter's Church, St. Louis, Mo. Pp. 21. 1902. Dr. Scarritt is an accomplished scholar and metaphysician, a favorite pupil and friend of the late Dr. Hickok, whose works stand high in American philosophy. This Review of Haeckel, directed against monism, shows a mastery of the subject, and is especially rich in references to the opinions of eminent philosophers and men of science, bearing on the subject discussed. The author exhibits his ability as a logician and rhetorician.

The "hard lot of the farmer" is one of the commonplaces of political discussion, but few people realize the extent to which the farmer has been aided by science within the last decade. In Scribner's Magazine for June the remarkable results of the Agricultural Experiment Station work will be described for the first time in a popular manner by W. S. Harwood. He shows that a revolution in methods has been accomplished through the researches of one thousand scientific men, and that whole regions of the United States have turned to raising new products through the lessons taught by these stations. The article, which is fully illustrated, is a glimpse into "a book of practical magic."

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News from Proctor's.

Manager F. F. Proctor's plans for his seven prosperous theatres are rapidly working into successful operation. The permanent stock company at Montreal has proven so popular that a resident company has been established at Albany and will be continued during the summer.

It is likely that a permanent company will also be established at the One Hundred and Twenty-fifth street. The Fifth Avenue will keep open all summer, as usual; that much has been definitely decided. The Twenty-third st. and Fifty-eighth st., will remain open for several weeks longer, straight vaudeville holding sway at the down-town house, and stock and vaudeville at the Fifty-eighth street.

The introduction of orchestras has also proven to be a popular move. The music gives a stimulus to the players and the vaudeville numbers are enhanced in value and effectiveness of presentation. Next season there will be full orchestras at all Proctor theatres. Manager Proctor, by the way, is the first manager to introduce orchestras with continuous performances; as he was the first to interlard the drama with vaudeville.

Toothache Cure.

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Earthquakes and Causes.

One of the most disastrous earthquakes of recent times is that reported from Russian Transcaucasia. The town of Shamaka has been practically destroyed, only a dozen houses being left standing, while a population of 25,000 has been rendered homeless. The number of fatalities is as yet unknown. Over 300 bodies had been recovered at the latest accounts.

To the student of seismic phenomena the interesting and suggestive feature in the Shamaka earthquake is that it has occurred in the neighborhood of the Baku oil district—the most productive field in the world, not excepting that of Beaumont, in Texas. It is, furthermore, a section of the world which has hitherto been exempt from these phenomena. The scientific inquirer will search for a cause, for cause and effect go together in the scientific analysis of all phenomena.

Is the great natural oil reservoir tapped by the oil wells of Baku, on the shores of the Caspian Sea, located under the site of Shamaka, and has the tremendous drain of mineral oil from the same caused a void and a subsequent shrinkage in the earth's crust in that neighborhood? The inquiry is not far-fetched. It is usually assumed that water takes the place of the oil withdrawn from the measures, filling the vacuum created by the latter's withdrawal, but if the water, being more tenuous, should find an independent vent elsewhere, the vacuum created by the draining of the mineral oil would remain, and a shrinkage of the unsupported crust of the earth would naturally follow sooner or later.

It has been suggested that the tapping of the oil measures in the southern part of California has relieved the mineral oil-bearing formations from the pressure of the gas created in them, and the possible subterranean gas explosions produced by excessive pressure, and thus removed one of the supposed causes of earthquakes in that section. There may be nothing in the theory, but it has been observed that the Los Angeles district has been notably exempt from seismic disturbances since the oil measures were tapped and vent given to the gases generated in them. Likewise, the theory that the Shamaka earthquake was due to the drain on the petroleum reservoirs in the Caucasus by the Baku wells may be entirely at fault. But the two phenomena seem to invite the attention of the scientist, and open a new field for the study of seismic disturbances. —San Francisco Chronicle.

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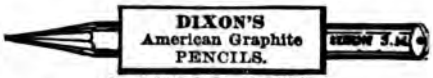

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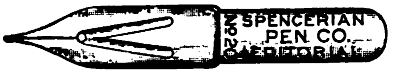

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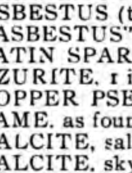

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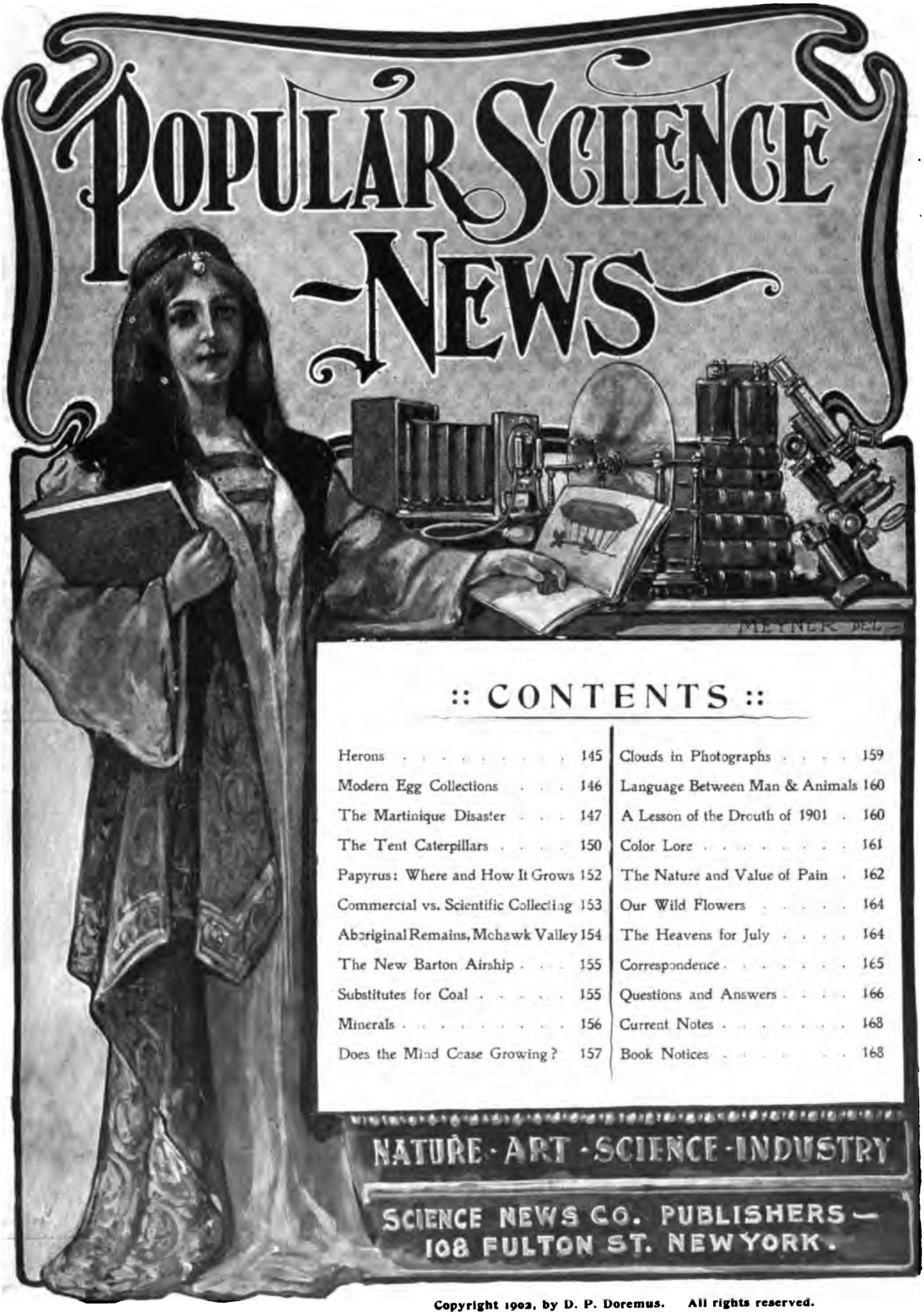
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Breathing Under Water.

Some years ago a diver's helmet was constructed by Mr. Fleuss with the object of enabling the divers to be independent of an external supply of air. In this apparatus the exhaled carbon dioxide is absorbed by caustic potash, whilst the oxygen consumed is replaced by fresh gas from a small portable cylinder communicating with the helmet.

A simpler apparatus on the same lines has recently been devised by Drs. Desgrez and Balthazar, of Paris. The main feature of their invention is the use of sodium peroxide, which was discovered in 1862 by Prof. Vernon Harcourt, though it has been but little used, except as a reagent in analytical chemistry. Commercial sodium peroxide is a yellowish white powder, which is extremely caustic and possesses strong oxidizing properties. On exposure to the air it absorbs carbon dioxide in the same way as caustic soda, being converted into carbonate, whilst on treatment with water it is decomposed into caustic soda and gaseous oxygen. Thus on placing sodium peroxide in contact with water in an atmosphere that is being breathed, the carbon dioxide will be continually absorbed and the oxygen renewed by one and the same substance. The apparatus applying this principle contains a clockwork appliance by means of which sodium peroxide is made to fall at regular intervals to water, whilst the violence of the reaction is moderated by a refrigerator. The apparatus is contained in a light circular box of aluminum, and is connected with the helmet by means of two rubber tubes. With the aid of this "oxygen generator" Dr. Balthazar has been able to remain for more than half an hour in an atmosphere saturated with sulphurous acid.—Science Gossip.

◆

How Chamois Skins Are Made.

The sheepskin is first washed and the flesh side scraped thoroughly to remove the fleshy fibers; then the wet skins are hung in a warm room for about a week and "sweated." This loosens the wool so that most of it can be pulled out easily. The skins are then soaked in milk of lime to loosen the rest of the wool and to swell the fibers and split them into their constituent fibrils.

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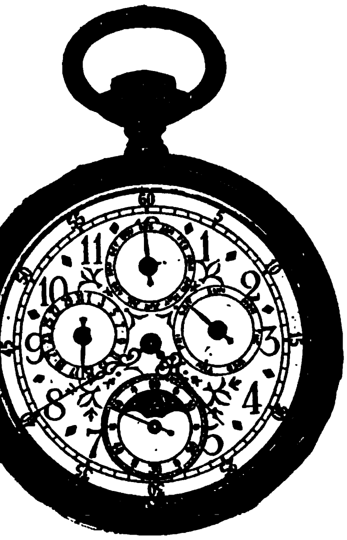

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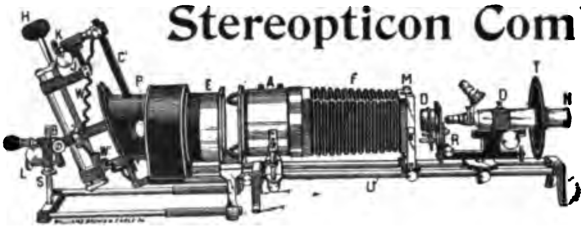

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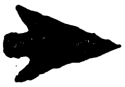

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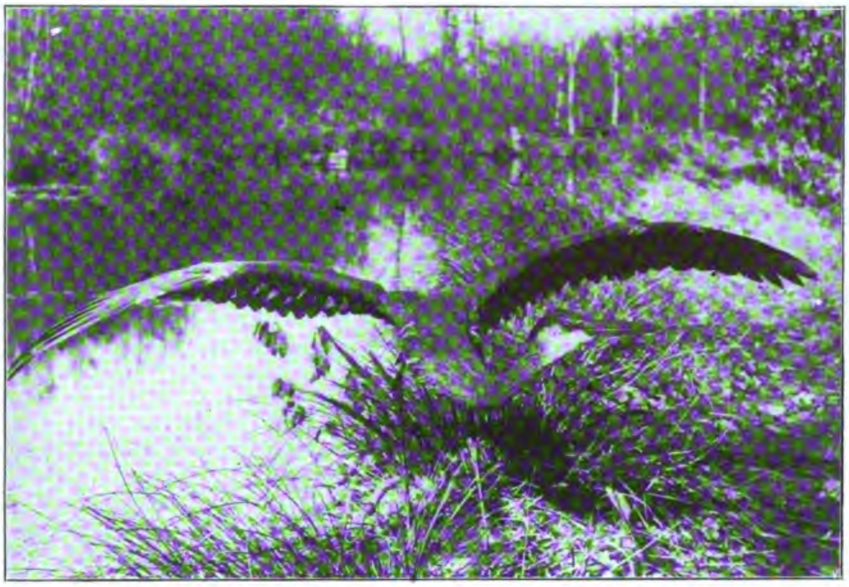

THE GREAT BLUE HERON.

HERONS

By **DR. R. W. SHUFELDT.**

WHEN we come to consider the interest that the world at large takes in certain birds or groups of birds, we do not have to proceed very far before the fact becomes evident that certain species or families have always held a more prominent place in the popular mind than has been enjoyed by others.

For instance, it is a great deal easier to command the attention and interest of people when we come to describe the habits and habitats of game and song birds than it is when we undertake to set forth our knowledge of the Skuas and Guans. It is in the first class that the birds called Herons and their allies most decidedly fall, and be the composition of the audience what it may, the moment we commence to tell of the life-history of any of the forms constituting this remarkable group, that instant we command the ears of our listeners. Far back into the earliest days of our history this interest has been brought about and is evidenced in many ways.

All through the mediæval period in the Old World when falconry was in vogue, the heron constituted the most frequent quarry of the dauntless falcon in the hunt; it often figures in heraldry; throughout time it has been one of the favorite feathered models for the artist and the sculptor. In modern times the entire group has been mercilessly persecuted to meet the demands of fashion; and, finally, the habits and characters of the existing members of the group in various parts of the world are so remarkable that they occupy many a page in popular ornithological literature, to the constant entertainment of children and the older folk everywhere. This last not only applies to Anglo-Saxon readers, but obtains among other nations of the globe, as witness the Japanese,—a people who regard certain species of herons even with veneration, and to destroy one in that country is in violation of the law, and jeopardizes the liberty of its slayer.

Herons are found in nearly all parts of the known world, and the common heron of Europe, the Ardea cinerea, of Linnæus, has long been considered the type species of the family. This "species," says Alfred Newton, the eminent British ornithologist, "inhabits suitable localities throughout the whole of Europe, Africa and Asia, reaching Japan, many of the islands of the Indian Archipelago, and even Australia. Though not so numerous as formerly in Britain, it is still common enough to render a description of it almost unnecessary, and there must be few persons who have not seen it rising slowly from some river-side or marshy flat, or passing overhead in its lofty and leisurely flight on its way to or from its daily haunts; while there are many who have been entertained by watching it as it sought its food, consisting chiefly of fishes (especially eels and flounders) and amphibians—though young birds and small mammals come not amiss—wading midleg in the shallows, swimming occasionally out of its depth, or standing motionless to strike its prey with its formidable and sure beak."

In our country we have a very close ally to this common heron of Europe. It is the Great Blue Heron, a bird that not only very much resembles it in general appearance, but that likewise possesses habits almost identical in nature. A figure of this latter species illustrates the present article, and has kindly been furnished me by Mr. Geo. E. Moulthrope, of Bristol, Conn., whose work it represents. Our heron is larger than the British species, while the largest species known to me has a wide distribution throughout Asia and Africa (A. goliath).

Besides the Great Blue Heron, we have in the United States several typical forms of the genus, as the elegant Great White Heron; Ward's Heron, which is confined to Florida; and then the continental species, just described, has accidentally occurred in southern Greenland.

Then, too, we have a group of smaller herons, which includes the birds known as Egrets, as the Snowy heron, the Louisiana heron, the Little Blue heron, the Green heron, with its subspecies, Frazer's Green heron, and the American and Reddish Egrets. These last have been so persecuted by the plume hunters, that they are practically threatened with extinction. Finally, there are the Night Herons and the Bitterns, all very familiar forms to us, and all with extremely interesting life-histories. So it will be seen that the avifauna of the United States is particularly rich in these beautiful bird-forms, while still others occur in our colonies, and in Cuba and elsewhere. Other most elegant types occur in Africa, South America and the East Indies, but my space admits only of mentioning this fact in the present connection. One especially beautiful heron is found in South America. Science has in its hands, too, the fossil remains of not a few herons that are now extinct, and it is very likely that these were as interesting in all particulars as the species still in existence.

Our common little Green Heron is a more or less abundant species, and familiar to nearly every one residing in the neighborhood of creeks, rivers, marshes, ponds or other bodies of water. Many call it the Green Bittern, or simply the Bittern, while still a greater number apply to it the by no means complimentary epithet of Schytepoke. This bird I have studied in many localities,—indeed, widely separated localities, and I am free to say that my delight in observing them in their haunts is quite as keen now as it was during my boyhood days, many years ago, when the study of birds meant so much to me. It is close on to forty years ago, in fact, since a copy of "Wilson's Ornithology" first came into my possession, and I read in it the excellent account of this well known bird, and what a pleasure it was in later years to confirm nearly every statement he makes in it.

Wilson, however, has noted some things about the Green Heron not seen by me; for example, he says it breeds "sometimes in single pairs, in swampy woods; often in companies; and not unfrequently in a kind of association with the Qua-Birds or Night Herons." For my part, I have always found the bird breeding singly, though I do not for a moment doubt what I have just quoted from this careful and truthful observer. What surprises me in Wilson's account is that he neglects to say anything about the habit the young in the nest have when they are molested by an intruder.

In this regard I very well remember my first experience, for in climbing up the tree to capture the four young ones that were about old enough to leave it, I was treated to being bespattered with the by no means savory and very fishy contents of the stomachs of the entire quartet, it being the invariable habit of these fledglings to thus attempt to intimidate their assailant and check his further advance. But I was a very enthusiastic young ornithologist, and this reception, in my case, simply resulted in my capturing the entire crew, and making a thorough inspection of the construction of the nest. This I found to be rather a bulky affair composed of small sticks and lined with finer twiglets.

Many of the larger herons, and some of the smaller ones, in various parts of the world breed in the trees in communities, and these places are called heronries. Often these heronries are not far from the habitations of man, but more frequently they are in the wilderness in the neighborhood of extensive swamps, rivers or marshy places. Much has been written about them and they are full of interest for any one who delights in the study of nature and the haunts of birds. Herons have bred in this fashion in confinement, and a fine heronry exists in the Zoological Gardens of London. Formerly, immense heronries occurred in many parts of Florida, but, be it said to the disgrace of this country in general and that state in particular, they have been nearly entirely wiped out through man's agency.

Entertaining stories are often told about herons, and Mr. Yarrell has given an account of a case in which "a heron struck its beak through the head of an eel, piercing both eyes, when the eel, finding itself unable to escape, curled itself round the neck of the heron, so tightly as to prevent the bird from breathing and they were both found dead in this situation!" Another writer says that during the middle ages in Great Britain, the heron was "called Heronshow, and not to know the hawk from the heronshow was deemed an evidence of great stupidity. Hence, we have the vulgar proverb, not to know a hawk from a hand-saw."

Among the most interesting forms of this family are the bitterns and the night herons, but I shall be unable to touch upon these here, the limitations of space forbidding. In closing, however, I must not forget to mention two birds that are considered to be more or less nearly allied to the true herons. One of these is the remarkable Boat-bill of the northern parts of South America (Cancroma cochlearia), and the other the famous Shoe-bill, of the Nile, in Africa (B rex). Both of these species are of great interest to ornithologists.

Balloon Struck by Lightning.

Lieut Hiller, of the German army, was experimenting with a war balloon at Augsburg, Bavaria, lately, telephoning his observations from a height of 1,600 feet to soldiers stationed below, when the balloon was struck by lightning. The balloon was set afire and destroyed, and Hiller fell to the earth striking on his feet and strangely enough escaping with only a few broken bones.

Modern Egg Collections.

The collection of eggs is a fad as old as the hills, and is as popular to-day as ever. In fact, of late years the encroachments of science upon daily life have given a new zest to the pursuit, and raised prices accordingly. At one time a collection which included the common birds of the state or a division of the country was considered among the first rank. To-day such a collection would be laughed at as a boyish plaything. The regular collectors desire to represent every leading member of the bird kingdom, while several hundred purchase the eggs of extinct and even prehistoric birds. The egg of the great northern auk, which died out more than a half century ago, is now worth anywhere from $1,500 to $2,000. The egg of the dodo, which lived formerly in Madagascar, is worth several hundred dollars. That of the dinoris, a giant feathered creature of New Zealand, is worth even more.

From these large figures the prices run down very rapidly. Those of the eagle family are as a class the most valuable. The golden eagle's egg brings $10, the bald eagle's $4, the great Swiss eagle $8, the snow eagle $8, the Greenland falcon $5, the Louisiana kite, $10, the Filipino fish eagle $10, and the fish hawk $1. In fact, it may be said that eagles' eggs average $7, falcons' eggs $4, hawks' eggs $2, owls' eggs $6, and kites' eggs $3. The eggs of the grouse and partridge family are very pretty in their markings and command good terms. They range all the way from 6 cents for the egg of a common ruffled grouse up to that of the Canadian grouse at 75 cents. There are 190 humming birds whose eggs are in the market, and although the latter are scarcely larger than beans, they bring exceedingly good prices, varying from 25 cents up to $10. The eggs of the duck and goose family are not of a very high priced variety.

The cheapest is worth a single cent, while one species of the wild duck costs $5. There are said to be 150,000 collectors in the United States, and the collections run from 1,000 to 50,000 eggs. If a collection has less than a thousand eggs it is hardly worthy of the name. The smallest egg is that of the Central American humming bird, the size of a pea, and the largest is that of an ostrich. The center of the trade was formerly in New York, but it is so no longer. The merchants say that the business has been broken up among fifty cities.

Coating of Smoke.

E. G. Clayton, of London, has been analyzing the incrustation on St. Paul's cathedral accumulated there during the last 200 years by the smoke and dust of the city. This crust was nearly an inch thick in some places. It was very hard, being in fact an artificial stone, composed largely of sulphate of lime.

THE MARTINIQUE DISASTER.

BY PROF. C. E. BORCHGREVINK.

Member Royal Geographical Society, Gold Medalist Scottish Geographical Society, Knight of St. Olaf, Delegate to the West Indies of the National Geographic Society, U. S. A., etc. Special correspondent "Frank Leslie's Popular Monthly."

The following illustrations and description of the volcanic eruption of May 8th, is taken from Prof. Borchgrevink's article by special permission of the Frank Leslie Publishing House, New York. Copyrighted 1902.

HUMAN tragedies so black that printed words cannot paint them were concluded by the thousands in the town of St. Pierre in those few minutes of destruction. I heard them not from those who escaped, because no one lived to tell the tale. not even that mythical prisoner whose picture has been so often printed by enterprising papers. St. Pierre, with its towers, its houses, its people, its lovely gardens, in a couple of minutes had all disappeared. A heap of stones and the remains of walls, dressed in ashes, were all which met the eye. The town itself is situated at the crescent beach to the southwest of Mt. Pélée, reminding one of Naples below Vesuvius, but neither Herculaneum nor Pompeii today in their desolation present an appearance of destruction so appalling as does St. Pierre on Martinique. As I walked among the ruins frightful sights came in view, all speaking of the suddenness of the of the catastrophe. The stench which met me was frightful. In the ruins of the cathedral the smell was overwhelming. That sweet, sickening odor which only comes from dead human flesh. One of our party fainted away. For myself it made me deadly sick. On I walked, fighting through the ashes under the burning sun, while mighty columns of smoke and steam continued to rise from the crater of Mt. Pélée. The sacrifice had been done and offered. But who is he who said that St. Pierre perished for its sins? He ought also be made to name the city which deserved to be spared!

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THE SMOKING LAVA BEDS OF PELEE.

In two seconds all human activity, manufactories, homes, hotels, everything had ceased. Some bodies were sitting in the position in which they were at the time death came. In one place a man was found in his office with his pen in one hand, resting his cheek on the other. In a restaurant a father with his wife and two children were still sitting around the table, looking so much alive that those who first saw them spoke to them before they realized that they were dead.

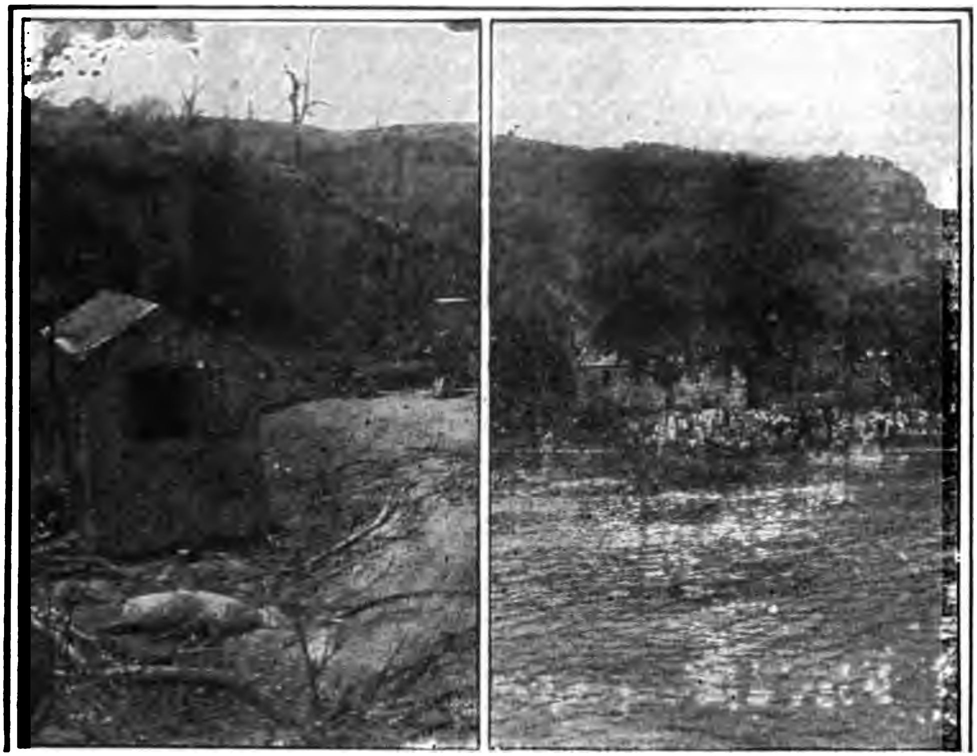
At Morne d'Orange, a fort was situated. There some four-inch canons had been thrown thirty yards away. The statue of the Virgin which was between fourteen and fifteen feet high, moulded in metal and must have weighed several tons, had been lifted bodily from its pedestal and carried some forty feet and hurled to the ground. Notre Dame de la Garde, they called her, Our Lady of Safety, and she used to stand framed against a background of vividly green trees, visible, like a watch tower, far out to sea. For many yards to the south of the colossal figure as it lay prone on the ground a perfect line of demarcation could be traced between the deserted track of ruins and the green and flourishing vegetation about it.

The line began to the south of Carbet, then curved to the northward until it reached the high ridge of the mountain behind. On the one side all was gray, barren death and desolation, on the other all was peaceful and seemingly full of content. The instantaneous force which must have ruled is incomprehensible to the human mind. As I have already mentioned, the effect of the burning was peculiar. I found a boy, his skin apparently whole, every muscle showing, and even the color light and healthful. I touched him, with my stick. The charred flesh was hard but within the body was hollow. Undoubtedly the sudden explosion of gases had burned the people internally as much or more than it did without.

The extraordinary resemblance between the condition of the town of St. Pierre after the first eruption of Pélée and that of Pompeii was noticed by all the scientific members of the party. The likeness was particularly striking in the manner in which the roofs of the houses at St. Pierre were blown off by the cloud of gas. Truly does history repeat itself.

Twice did I go to St. Pierre, for two days I roamed in the ruined city. The first time in company with Commander McLean, of the United States man-of war Cincinnati. He had visited St. Pierre after the first eruption, when some houses in the center of the city were still standing. His ship had been lying in the harbor at Fort de France on the 20th during the second eruption when stones rained down on the deck, and he told me that even human bones were found amongst the ashes on the deck of the Cincinnati.

Fine and light as the volcanic ashes seemed as they floated in the air, yet the total weight that fell on the island must have been very great. On the deck of the Cincinnati the officers measured off a square space and carefully weighed the volcanic ashes that fell during the period of the second eruption. It was estimated, according to this calculation, that the fall of ashes weighed about four hundred tons to the square mile. Angle measurements were taken at the same time of the height to which the column of smoke and ashes rose above the crater, and it was calculated to be a little more than six miles. Among the débris that fell upon the Cincinnati's deck was a fragment about three inches long, and this it was which the ship's surgeon identified as a human bone.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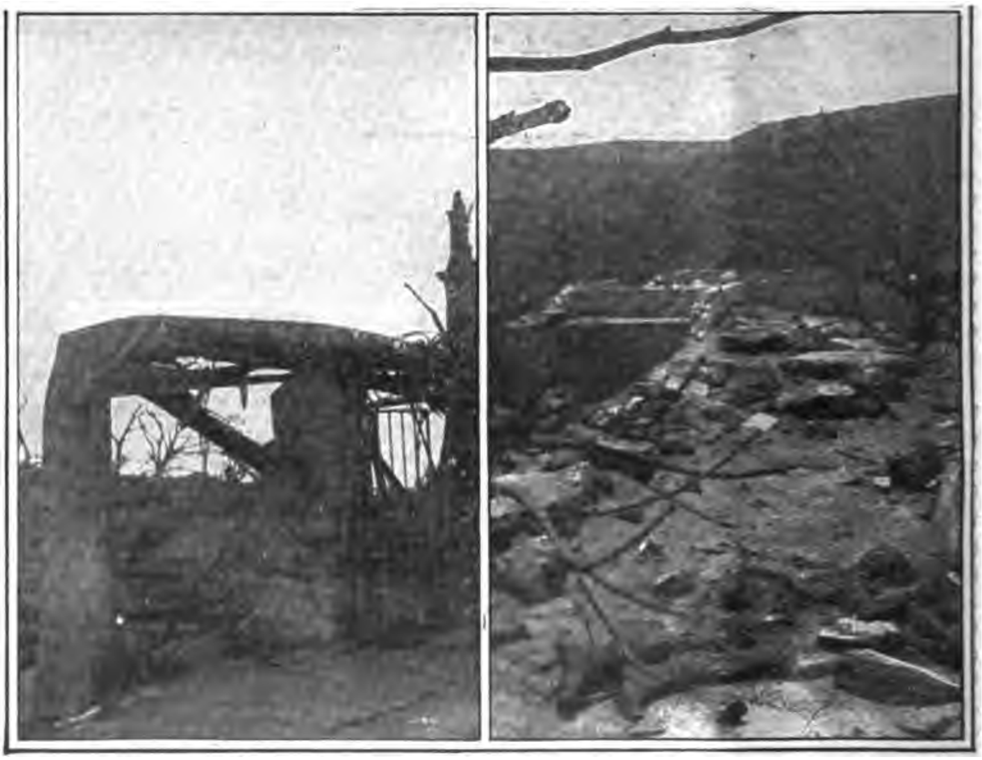
INTERIOR OF FORT AT MORNE D'ORANCE. TERRIFIED REFUGEES NEAR MT. SOUFRIERE.

Commander McLean again visited St. Pierre with me on the 21st of May, and the great change which, according to his idea, had taken place between the first and second eruption was conspicuous, as no buildings whatever were standing on the 21st.

On the 22d of May I again visited St. Pierre with Captain Berry, of the Dixie. The volcano was evidently in an angry mood. Tremendous clouds of steam shot up from the crater, followed by a sudden outburst of black smoke; also this time we proceeded towards the volcano.

Towards the northwest on the gently sloping base of Mt. Pélée columns of steam and smoke rose through the crevices of the dry crust. Suddenly the ground near us burst. Steam shot up through the air, first beautiful and white, then black, and a strong smell of sulphur spread about. The column of steam and smoke from Pélée descended suddenly towards us. This had been observed on board the Potomac in the bay, and with repeated blowing of whistles warned us of the approaching danger. We at once ran towards the boat, and suddenly from the very spot where we had been standing burst forth a new cloud of smoke and steam, black and threatening, while the smell of sulphur grew more intense. We ran for our lives. It seemed hell itself. All along the beach steam rose as the hot, flowing mud met the cool waters of the Carribean Sea. It seemed as if an evil ghost himself lit the fires behind us as we fled, and when we reached the boat the clouds of jet black smoke were already in the town and the sulphur smell was strong, while a sudden gust grabbed several acres covered with ashes and brought the fine dust up in a whirling column similar to a waterspout, moving with tremendous speed in the direction we were running.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THE WRECK OF A GATEWAY AND VILLA NEAR ST. PIERRE.

A SUMMARY OF SCIENTIFIC OBSERVATIONS.

It is evident that the earth crust, above water as well as at the bottom of the Carribean basin, is in an excited state and changes are constantly taking place in its conformation. Mount Pélée on Martinique, and Mt. Souffrière on St. Vincent are in sympathetic relation with each other. When one ceases activity the other at once shows a tendency towards eruption, and this volcanic activity extends generally, even to the adjacent islands where, however, eruptions have not taken place during the recent disturbances. Many symptoms indicate their communication with Mt. Pélée and Mt. Souffriere. This sympathy between volcanoes lying at a considerable distance I can best explain perhaps by the homely simile of a great pot of porridge boiling over a fire. The steam below seeks to escape now here now there and bubbles rise, burst and fall all over the hot surface. It doesn't seem to me at all probable that the recent eruptions of Souffrière and Pélée have terminated the present geological events in the West Indies.

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A VIEW SHOWING THE SPASMODIC ERUPTION OF MUD, DAYS AFTER THE DISASTER.

There evidently still exists a very strong pressure below the earth crust in this locality. The escape of steam from the craters will momentarily lighten the pressure, but when the molten conglomerate stiffens a fresh outbreak is likely to take place wherever the facilities for breaking are the best. A great outflow of volcanic mud has taken place both at Mt. Pélée and Mt. Souffrière, but I did not see any outflow of lava. The volcanoes on the West Indian Islands ought to be studied systematically and reports by responsible scientific men should be forwarded from time to time to the proper offices, giving a minute description of the state and behavior of the volcano. In this way a timely warning might be given to the citizens of those cities which lie within the reach of such dangerous neighbors as Mt. Pélée and Mt. Souffrière. The great possibility of the loss of life and property on the one hand and the immense value of such scientific observations on the other are reasons which cannot be brushed aside, and which ought to constitute weighty arguments in favor of systematic investigations being carried on all over the West Indian Islands. It would be a noble task if the United States by such work should endeavor to protect life in this region of the world, where its beneficient influence has already been established.

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THE TWO CRATERS OF LA SOUFFRIERE.

The volcano is certainly still in a dangerous condition. If any parallel can be drawn from the actions of the volcano of Krakatoa, where the eruptions were in many ways strikingly like those of Pélée, it would seem likely that the recent disturbances would be repeated at intervals for many weeks. Krakatoa, in 1883, was in a state of intermittent eruption for more than fourteen weeks, until the island was finally blown into the air.

All elevations in Martinique belong to six groups clustering about six ancient volcanic centers, La Pélée, Pitons, du-Carbet, Roches Carres and Nauclin, Marin, and Morne de la Plaine

Forty-two distinct mountain masses belong to the Carbet system alone, while Pélée includes but thirteen. It is an interesting fact that Mt. Pélée occupies an area corresponding to that of Mt. Ætna, and like that famous peak it is almost unique among volcanoes owing to its moderate height. In my opinion electricity plays a much larger part in eruptions than has hitherto been supposed. I do not base this belief merely on the lightning which was constantly flashing around the craters, but from the state of the iron bars and the wire, which were lying about in St. Pierre. First of all it is shown by the great influence such disturbances have on magnetic instruments and I believe a study of volcanic problems will have to be pursued along very different lines from those which have hitherto been followed by scientists.

Many of the more luxurious and elaborate houses were distinguished even in their leveled ruins by large baths often twenty feet in diameter and from four to six feet deep. These were now choked with mud and rubble and ashes. In one of them we came upon three bodies charred and nearly destroyed. It was evident that these poor wretches had rushed to the baths for coolness and protection, which they had tragically failed to find. In one house a body was found with its head thrust deep in a wash basin, while over the basin, head and all was a pile of dry, gray ashes.

In the midst of the chaotic and apparently complete destruction around us, with gardens piled high with debris and cellars frequently laid open to the air, we would occasionally find a house not utterly leveled to the ground.

In my official report to the National Geographic Society in Washington, I shall touch more closely and in greater detail upon the electrical feature.

Animal Life

THE TENT CATERPILLAR.

BY D. S. HARTLINE.

Among the many different kinds of moths that could be seen last summer, was one kind, the individuals of which were "dull reddish in color, more or less brown-tinged, having on the fore-wings two oblique, pale stripes." It is called Clisiocampa Americana. The figure shows the form and general appearance of the creature but not the markings. The female, which is a trifle larger than the male and more conspicuously marked, could be seen flitting about wild cherry and apple trees early in the summer, and if closely watched could be seen depositing a mass of eggs in the form of a broad band about a thin twig (Fig. 1).

The eggs were embedded in a glue-like substance which, hardening about the twig, both held the eggs in place and protected them from the weather. The moths soon disappeared but the egg masses remained undisturbed through the remaining summer, the fall, and the winter months, and when the first warm days of spring came along, from each egg in the cluster of about five hundred or more, crawled a minute hairy caterpillar. The buds on the trees were just unfolding, and to these the caterpillars immediately found their way and instinctively recognized them as their prey. And now the struggle for life began. The tree for nine months had been effectively giving aid and comfort to its worst enemy. The moth had wisely chosen. Her eggs had been carefully laid on the tree that was to furnish the food for the caterpillars that were to hatch from them—her offspring.

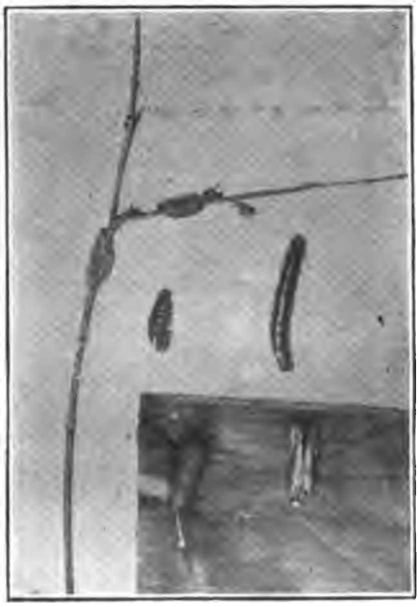

FIG. 1.—THE MOTH.

The tree, in the early spring, when the warm days come and the gentle rains fall, feels the "stir of might," and straightway plans to thicken its trunk and lengthen branches and twigs and produce seeds for a new generation of trees. To this end its buds expand and the young leaves come out into the air and sunshine, and in this case into jaws of the caterpillars. Life for the caterpillars is merry, for the tree sad. The caterpillar eats, drinks, and grows big and fat. See Fig. 1. To provide shelter during the night and during cold and wet weather, he and his companions, as soon as they have found out the nature of their place ot abode, cooperate to build a silken tent in the nearest crotch of the branch that bears the twigs on which they were born. (Fig. 2). To this they retire for rest and shelter. From this they march, whenever hunger impels them, to their pasture ground.

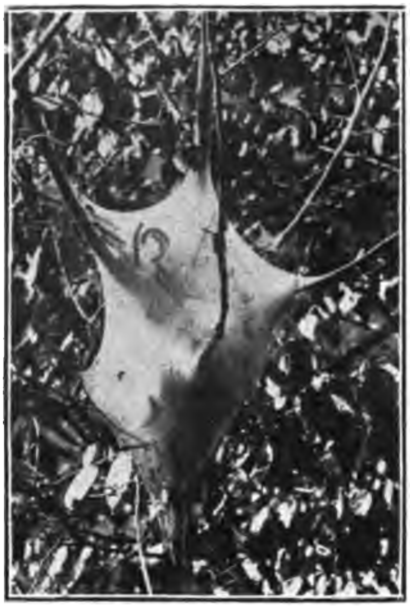

FIG. 2.—TENT WITH CATERPILLARS.

As they do their eating for their whole life-time, during this period, most of their time, when weather and light permit, is spent in this pleasant occupation. The more they eat, the larger they grow; the larger they grow, the more they want to eat. Against such an onslaught as this from such a horde, the tree makes little progress towards complete foliation. The branch on which they were hatched is soon robbed of its leaves. They crawl to the trunk and out on other branches, some here, some there; they let themselves down by silken threads to the lower branches. Their tent becomes too small. They build larger ones, enveloping the old one or build in other crotches. Wherever they go, they trail behind the thread of silk. This habit secures them against a fall, for the thread sticking to the branch, suspends them from the branch and enables them to let themselves down gently; it also makes travel over much-used routes easier, especially when the routes lie over rough bark (Fig. 3) or, in some cases (Fig. 4) over grassy stretches from one tree to another.

This migration to another tree is necessary, because only large trees furnish enough food for the entire colony till all are ready to pupate. By this time the tree is entirely denuded of leaves and practically covered over with silken webs. (Fig. 5.) Now the caterpillars hunt other trees and shrubs In this search, they may be seen hanging in clumps on small weeds, and shrubs, and fences. They may not find the same kind of tree they have been feeding on, so they will take the first thing that comes into their way. Now, about the first of June in our locality, they are ready for their second transformation—pupation. They find a quiet, protected place, and each spins about his body a white silken cocoon, covered with a powdery substance. In this pupa state they remain for about three weeks. From these they emerge into the imago state—i. e., develop into moths—the third and last transformation. This is the form of the parent—the adult form. Now fertilization and egg-laying take place, and the life cycle is complete. These stages are shown in Fig. 1. The caterpillar has accomplished his life purpose. The tree has spent his time and energy in feeding his enemy.

Worse than this, some of his own life substance and vitality has gone to nourish the caterpillar. By this time the tree ought to be in blossom and expending energy in providing for a new generation of his own kind, as well as laying up stores for his own growth. And the determined effort put forth by the tree, to produce fruit is often pathetic. Sometimes a single little twig will bear an uninjured spray of blossoms and a leaf or two. All the rest of the tree stands out, naked, as if dead, in strange constrast with its neighbors clothed in the beauty of

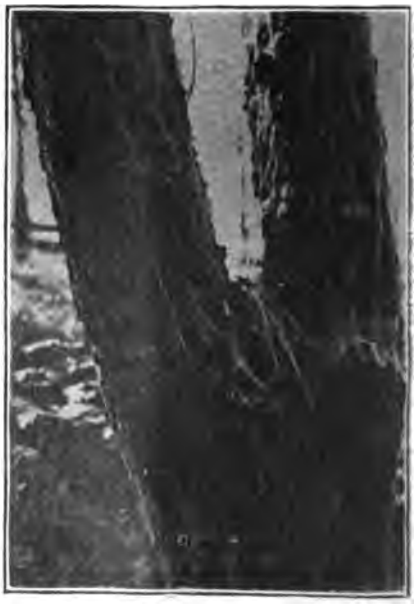

FIG. 3.—SILK THOROUGHFARES.

their foliage. (Fig. 5.) When we remember that leaves are at once the mouth, stomach and breathing apparatus of the tree the seriousness of the tree's misfortune is at once evident. The one saving feature is in the fact that this happens early in the season. Before the season is over the tree will succeed in putting forth a new growth of leaves and so providing for its own growth, but the crop of fruit is lost. In the case of wild cherry, which is the preferred prey of this tent-caterpillar, as we do not use the fruit, we do not feel the economic effect of this plant waste. But in the case of the apple tree, which is so seriously infested at places that every tree in entire orchards is denuded, the loss in dollars and cents to man is serious. And when the whole area that is now infested is considered, we feel that the outlook is gloomy.

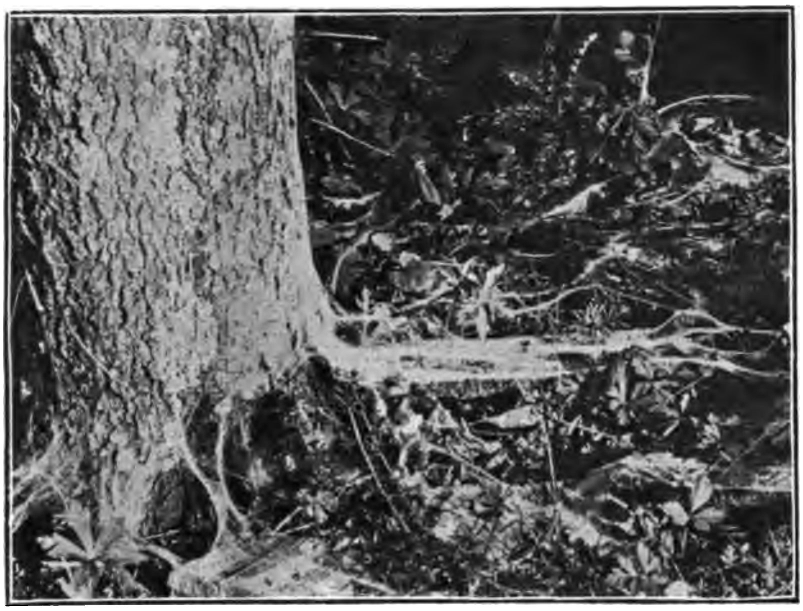

FIG. 4.—SILKEN AVENUES LEADING TO OTHER PASTURE GROUNDS.

In 1899 the pest was quite insignificant in our locality. In 1900 the increase was quite alarming. But this year the number seems double that of last year. And they have spread in these great numbers all through the valley of the north and west branches and the main stream of the Susquehanna, and the country eastward. Their great abundance in the apple orchards and the apparent indifference of the owners is most deplorable.

It is evident that the balance of life has swung to the caterpillar side. The natural enemies are incapable of keeping in check the ravages of the creature. Of the birds, even the Baltimore Oriole seems surfeited with the caterpillars. While the photographs were being made for these cuts, a female oriole was seen on a nest in one of the trees shown in Fig. 5, pulling out caterpillars, pinching them, and with a shake of the head flinging them aside. I have not seen other birds eat any this spring.

A farmer in New York communicated a nice observation to the Rural New Yorker. He saw the larva of Ichneumon flies infesting the larva and reports a great decrease in the pest by the help of this useful insect. The caterpillar has many other natural enemies, but he has evidently in our community gotten away from them and we must resort to vigorous measures to save ourselves from serious losses.

Except in the case of high trees, the easiest and surest method of exterminating the pest is to cut off the twigs bearing the egg-masses in the winter, when leaves have fallen and the egg-masses can easily be seen. Those that hatch out can easily be destroyed early in the spring, while they are small, by burning the nest on a cold, wet day, or in the evening when all have returned to their tent, or by spraying the foliage with arsenites.

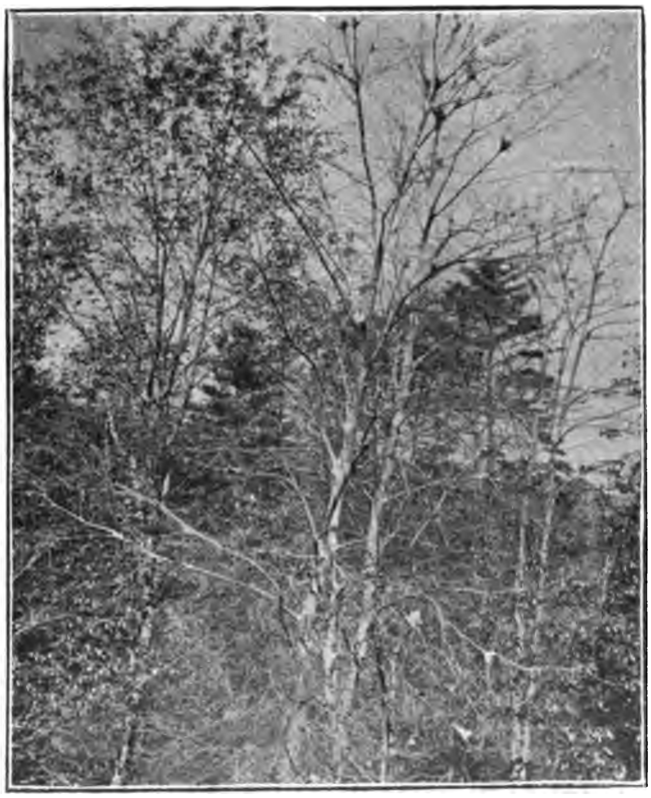

FIG. 5.—DEFOLIATED TREES, SHOWING TENTS.

Slaughter of Monkeys.

There has been an increase of nearly $30,000 in the value of monkey skins exported from the Gold Coast, and the warnings issued by past colonial governments have been unheeded. In 1896 it was reported that during the six previous years no fewer than 884,768 skins had been exported. It is only skins that are in good condition, with few shot-holes, that are capable of being disposed of. It is estimated that during this period as many as a million of monkeys have been massacred in the Gold Coast district alone.

Heat from Incandescent Lights.

It is a general opinion that incandescent electric lamps give out comparatively small quantities of heat. Measurements show, however, that of the energy of the current only 6 per cent. is turned into light; the other 94 per cent. manifests itself as heat. Inflammable substances near incandescent lamps are readily ignited. If a sixteen-candle power lamp lighted by a current of 100 volts be immersed in a vessel containing 300 grams (10½ ounces) of water, it will bring the water to boiling point in an hour. Celluloid near such a lamp is inflamed in five minutes. These and other experiments of the sort direct attention to the necessity of care even with electric lights.

Plant Life

PAPYRUS: WHERE AND HOW IT GROWS.

BY EVELYN CLARK MORGAN.

Considering the manifold uses made of papyrus by the Egyptians and the esteem in which it was held by the ancients generally, it is singular that it has become extinct in its native land, even on the banks of the Nile, where it flourished, and that there is but one place where it may be seen growing in its wild state to-day. It was our fortune to visit this spot in the most beautiful of all the Mediterranean isles, and to see it growing on the banks of the legendary Anapus in Sicily, where it has flourished for more than two thousand years. The Anapus is swift and clear as crystal, but very narrow, in some places scarcely more than twelve feet in width, and in the widest, not more than eighteen or twenty feet, and it is difficult to imagine a more charming effect than that of the violet-green feathery plant bordering its banks for a distance of a mile and a half or perhaps two miles. Seen through the limpid waters, the grasses and aquatic plants that cover the river-bed, are scarcely less beautiful than the stately plumose plant that, mirrored above them, sways and bends, responsive to every air that blows, till its fluffy tips droop in the pure waters and it rises again in new beauty, showering jeweled drops from every tiny point. The stalk grows from nine to twelve feet high, is a delicate, tender green from root to crowning plume; it is eight or ten inches thick at the ground, triangular, and tapering towards the top, where it ends in a graceful, sweeping fringe. The inner covering of the stem is divisible into thin layers and is full of a saccharine juice.

It takes between two and three hours to reach the papyrus banks from Syracuse, and, even if that city was not the most interesting of all the cities of the history-enfolded isle, days spent there in studying the alien plant would still be red letter days, and hours spent on the Anapus, golden hours. Vegetation is rank along its banks, thistles, cane and ailanthus growing in wild profusion and the tall papyrus overtopping them all. The waters catching and multiplying a thousand beauties, rush on to join themselves (or are wedded, as the romantic legend has it) to the waters of the Kyane fountain. This fountain, said to be formed of friendship's tears (those of Kyane for the loss of her playmate, Kore, who was carried off by Pluton), is clearer, if may be, than the river itself, circular, shaded and cool, and abounds in multi-colored specimens of insect life. Game is plenty along the Anapus shores and one catches glimpses of sportsmen half concealed among the fringe-topped papyrus, and meets picturesque groups of peasants returning to Syracuse laden with its graceful stalks of tender green.

Papyrus is almost as closely identified with the history of Syracuse as are the poet Simonides, her Greek Theatre and her Roman Arena, for it was Hiero the Second, who at the close of the first Punic war, received the plant from Egypt among other gifts sent by Ptolemy in recognition of valuable assistance offered the Rhodians by Hiero, at the time of a disastrous earthquake that nearly destroyed their city. The Romans, at the time, were in possession of Sicily, except certain parts over which their ally Hiero, king of Syracuse reigned, and the gift of papyrus brought from the banks of the Nile, and presented in the name of the Egyptian king, to Hiero (who caused it to be planted on the banks of the historic Anapus) was doubtless not without significance.

GROWING PAPYRUS.

Besides gathering the plant for the purpose of selling to strangers, the Sicilians imitate the Egyptians in the use of its stalk. They strip off the outer bark and several layers of the skin, till the finer quality growing near the center is reached. This they procure in sheets as large as the size of the plant will permit. A number of these are laid on a flat surface, with other pieces across them, then to bring the sticky secretion to the surface and cause the carefully fitted parts to adhere, they moisten all with a hot solution of flour and water. After being pressed and dried in the sun, the result is a strong fabric, slightly yellow and showing the cross fibre. On this the native artists paint quaint pictures, usually characteristic of Sicilian life; the picturesque peasant, the old church from which the Sicilian Vespers rang out, or the *carro* frescoed with religious or mythological subjects and drawn by a diminutive donkey. These souvenirs sell for a good price and are quite a source of income to the Syracusans.

While the Assyrians resorted to tinted clays, hardened by baking, to preserve their writings, in Egypt thousands of books were written on papyrus. In the ruins of Herculaneum 1,800 papyrus manuscripts were found. Long after the invention of cotton paper, papyrus was preferred—as being more durable—for valuable documents. It was used by the ancients with great economy, and was taxed by the Roman Emperors. During the reign of Tiberius there was a paper famine when the Senators allotted portions to persons according to their need.

The Egyptian growers reared the plant, but scarcely, so as to keep up the price, and at one time, during the founding of the famous Alexandrian library in the time of the Ptolemies, its exportation was prohibited, resulting in the use of sheep and goat skins for writing purposes. The layer of papyrus skin nearest the center was kept for sacerdotal writings, while for ordinary purposes that nearer the bark and much coarser, was used. It was formerly supposed that the Nile water had certain properties that increased the adhesiveness of papyrus.

Pliny and other early writers adhered to this theory, which has since been considered a fallacy. Pliney writes at length anent the papyrus and its many uses. It was greatly esteemed as an article of food either steamed and served piping hot or eaten raw. Reduced to powder and dissolved in wine, it was taken as a sedative. The glutinous substance in the bark was considered to have curative properties, and when moistened was used as a healing plaster. Cooking utensils were fashioned from the root (which is large and hard) and of the bark, mats and sails were made and even raiment, it was also twisted into rope, and owing to its combustibleness it was used for fuel and sometimes as a covering for the funeral pyre. It was not till the time of Alexander the Great that papyrus was generally known in Greece.

Peat in the United States.

The occurrence and uses of peat are described by Mr. Heinrich Ries in "Mineral Resources of the United States," 1901, now in press, United States Geological Survey. Peat is most commonly formed from a moss, which thrives in moist, north temperate climates. There are probably, says Mr. Ries, no large areas of peat in the United States equal to those found in Ireland and northern Germany, but many small deposits exist, some of which may cover several hundred acres. Except in the case of those close to the Canadian border, most of these peat deposits are probably rather high in ash or mineral matter. These impure peats or muck make a very rich soil. The peat is at times underlain by marl, or in rarer instances by bog iron ore.

The best known use of pure, or nearly pure, peat is as a fuel, but with wood and coal cheap no successful attempts have been made in the United States to utilize it for this purpose. Peat can also be used in the manufacture of gas, alcohol and charcoal. On account of its fibrous character it can even be successfully worked up into paper, cloth or rope. The partly decomposed moss has valuable antiseptic properties, and under the name of "moss-litter" is sold for bedding in stables. The growing moss is also used as packing material. It is in the three last mentioned applications that the successful use of American peat is probably to be looked for. Curiously enough, peat for packing purposes is sent from Holland to the United States, where it is used for packing American wines, which are then exported to Europe. The peat industry of the United States seems as yet not to have gotten beyond the experimental stage.

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Cultivating Flower Beds.

The general gardening public does not always recognize that cultivation of the soil is not alone for the purpose of keeping down weeds and giving a good appearance to the beds. Farmers harrow their corn and potatoes when there is not a sign of weeds. Why? It keeps the soil in a better condition for receiving and retaining moisture; it aerates the soil, which is essential to the decomposition of plant food it contains. Especially is cultivation necessary around young and recently transplanted plants. The difference between the growth of cultivated plants and those not so treated is often remarkable and favors the former method.

The manner of cultivation is important. Some men will use the hoe so that the top layer of soil is cut off clean and gathered up with the weeds that may have been the chief object of the hoeing. The surface remaining will be hard and smooth—quite the reverse to what it should be. Cultivation should mean a stirring of the surface, making it fine. If this be done in loamy soil shortly after a rain, it will not break into lumps.—Meehan's Monthly.

◆

New White Lead Process.

New York capitalists have formed a syndicate to compete with the National Lead Co., or lead trust, especially in the production of white lead, for use in paint. Practically all white lead has been made till now by the "Old Dutch process," by which the corrosion or oxidation goes on slowly for several months. The new concern has a new patent process which does the work in three days. It consists mainly in dividing the lead up into hair-like fibers, by forcing it while hot through extremely fine holes, thus giving a much greater surface for the acid used to act on.

Archaeology

Edited by Warren K. Moorehead, M. A.

COMMERCIAL VS. SCIENTIFIC COLLECTING.

BY WARREN K. MOOREHEAD.

The wise man collects for his own pleasure. His expenditures, his trips to favorite localities that he may personally roam over freshly ploughed fields, his hours spent in arranging his cabinet during winter evenings are all labors born of love.

Not so the commercial collector. This person cares not for the attractiveness of his surroundings. Neither the songs of the birds nor the freshness of advancing spring appeal to him. If he be out in August he heeds not the broad acres heavy with fragrant clover. Nature is nothing to such a person. He does not hunt, he cannot fish. Too lazy to work, he ekes out a miserable existence by selling the "relics" of a vanished people to such as may buy. I know a score of these men. They render the life of curators miserable by their frequent requests—"buy this" or "let me sell you that."

Speaking of vandals, no state has suffered more at the hands of reckless, careless mound diggers than Arkansas, and especially the "pottery belt" of that state. The fine clay vessels found in considerable numbers are highly prized by wealthy collectors. Four or five adventurers, trappers and men who have a superficial education and no regard for science, have carried on explorations in the past. A number of large collections have been made, and perhaps twelve or fifteen thousand pieces of pottery are now in museums, in the hands of collectors and otherwise scattered throughout the country as a result of their labors. No notes, drawings or photographs accompany the specimens. No reports have been published. One simply sees the long rows of "pots" on the shelves and a general label, "From Mounds in Arkansas," accompanying the exhibit. Future generations will have only these vessels to study, and our knowledge of prehistoric life in Arkansas will be more scanty than that of any other region of the country.

The honest, intelligent and careful collector is a worthy person and one to be commended. He knows his region and takes satisfaction in that knowledge. He places no fictitious value on his cabinet. That there is no such thing as an arbitrary value on a pipe, tube or jar he is aware. He wishes to have his cabinet preserved, not scattered, and when he dies, it will be of real value to future generations.

There is no greater fallacy among collectors at the present day than this—specimens have a monetary value. I could name several men who have abandoned fairly remunerative pursuits and become dealers. Not one of them has made a success. They have ransacked the graves, mounds and cliff-houses, dragged forth the humble arts of simple aborigines long since dead and sold them for a few paltry dollars. The destruction of archæologic testimony wrought by these vandals is something beyond compute.

And yet no one can blame a collector for selling his exhibit when he is through with it. But he should have in mind its preservation. Duplicates may be spared from a collection, but to sell all the poor objects and keep only the fine injures the cabinet.

No museum needs more single specimens, or "pretty and perfect relics or objects just to show 'art forms.'" The museums are full of axes, celts, pipes, banner stones, discoidals, hematites, tubes, slate ornaments and ceremonials, pestles, hammers, etc. What the museums need (as of great value to archæologic science) are collections from a special section, including everything found in that locality. They want the finds of the village site, the studies in unfinished specimens, the poor and the good, the imperfect as well as the perfect. In this regard the collectors make a great error. Most of them do not save everything, but cling to the "pretty relics" and discard the rough and the rude. Personally, I would give more for a collection, provided it contained all the finds of a certain valley, than for just the fine, perfect objects of that valley. From a collection of the latter I would be misled, for, if I accepted it as indicative of the status of culture of the people of that valley, I would say that they made most beautiful works of aboriginal art, nothing rude or unfinished being turned out by their artisans. In such a statement I would be unpardonably wrong.

Correspondents frequently ask this question: What are specimens worth? They have no real value. They are worth to a museum just what the buyer and seller agree upon. The catalogues of dealers give not only fictitious values, but no museum recognizes them.

The cash values should be discouraged. They are incentives to fraud and conducive of destruction of monuments. As an instance of the latter, I know a man who enjoyed a fair salary as a revenue officer in Tennessee, had a small collection containing pottery, effigy pipes, etc. He sold this for a sum—to him large. Immediately he abandoned his occupation and became active in the destruction of mounds and graves. He sold a second collection. To-day he is worse off than when as a government employee he spent his leisure hours in collecting for pleasure. He has not helped his family and instead of accomplishing a desired result, he has done archæologic science an injury.

Suppose a beginning collector or one who has spent some years in gathering specimens. If this young man wishes to accomplish something of real worth in the world, let him fit himself through a liberal college education, followed by a two or three years course in some museum. Then he is prepared to occupy a dignified position in his chosen profession. There are opportunities for all who will do this.

The specimens are gradually drifting to the permanent museums. Every year sees new museums founded. Each season an increasing proportion of archæological cabinets finds its way into permanent quarters in fireproof buildings, and there these things can be studied and protected. The collector, who faithfully preserves with correct data the material discovered in his neighborhood, enjoys through many years his archæologic pursuits, and when he is through with his collection presents it to a worthy institution, renders science a service and perpetuates his own name.

ABORIGINAL REMAINS IN LOWER MOHAWK VALLEY.

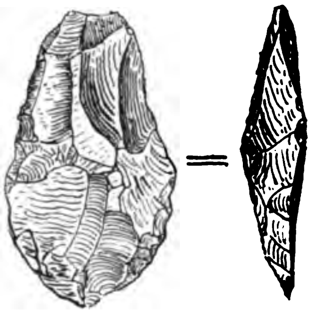
BY PERCY M. VAN EPPS.

The Lower Mohawk Valley is used in this and succeeding papers as a term embracing all that portion of the Mohawk river valley from Amsterdam eastward to the junction of the Mohawk with the Hudson at Cohoes, a distance following the sinuous curves of the river in its lower portion of about 37 miles, and such contiguous territory on either bank of the river as was occupied by the aborigines. Over this whole region the Mohawk nation in the height of its power held sole sway as well as over a much greater extent of territory to the south, west and north. Yet nearly all of the sites of camps or the work-shops and grave finds in the region appear of an earlier origin, probably dating from the time when the "River Indians" or Stockbridge branch of the Mahicans occupied the lower valley. Some new finds indeed have an appearance of a still greater age.

The approximate date of the first appearance of the Mohawks in this region is quite certain, but regarding the length of time the valley was visited and resorted to by the Mahican people, we can know next to nothing; it may have been several centuries. If the absence of pottery at the camp and other sites be a criterion, it would appear that the Mahicans never made permanent village homes here but visited the region on hunting and fishing trips only. Of still earlier occupation of the region in question, little has been disclosed and no theories paleolithic or otherwise, will be advanced in this paper, yet speaking from the knowledge gained by many years' careful search and observation of the objects recovered, it appears well nigh certain that some autofacture must be assigned to a considerable antiquity, in short of an origin and make far antedating any occupation of the region by the redman.

Among these will be mentioned a chipped flint of the much-discussed turtle-back form. This implement, of which an illustration is given, is rather neatly flaked from a greenish-colored flint, and has been dressed to a quite symmetrical outline. Its convex surface is about two-thirds covered with an unmistakable dendritic growth—an ear-mark of antiquity. While only a surface find from the western margin of the Saratoga Plains, yet from its antique form and dendritic patina, which does not occur at all on the common surface-find it may safely be classed as the handiwork of a more ancient race than either Mohawk or Mahican. Possibly a memento of the race that left undisputable evidence of its ancient pipe on the glacial clay at Saratoga Springs.

This discovery of an ancient fireplace was made in 1865, and inasmuch as it has been ignored (apparently with design) by those who deem it the proper thing to deny any and all evidence of the existence of man at an early date on the Atlantic slope, it may be well to repeat it here, quoting from a paper by C. F. Fish, on the mineral springs of Saratoga, in Popular Science Monthly (May, 1881), page 32. Speaking of the High Rock Spring—"Up to 1865 there had never been any attempt made to secure the flow by artificial means, but in that year the proprietors conceived the idea of removing the tufaceous rock, and by excavating to a sufficient depth obtain water of better quality and in greater abundance. In accordance with this design, the rock, which measured four feet in height and about eight in diameter at the base, was carefully removed from its original position, and the work was commenced. After having penetrated the superficial deposits, a layer of seven feet of commingled muck and tufa, superimposed upon two feet of tufa was encountered. Immediately below this the workmen found the trunk of a Pinus alba, which measured about a foot in diameter, and which was in a fair state of preservation. The next stratum was tufa, three feet in thickness, below which was two feet of drift. Lying immediately below this, a glacial clay bed, eighteen inches in thickness was found, upon the surface of which an ancient hearth was discovered, composed of a semicircular row of stones, partially surrounding a quantity of charcoal, over which an incrustation of tufa was deposited. This circumstance was one of particular interest to students of archæology, as it involved the solution of a vexed question regarding the time at which the fire was kindled, as well as the character of the race, and the manners and customs of those by whom it was lighted."



FLINT BLADE OF PALEOLITHIC FORM WITH DENTRITIC PATINA, FROM GLENVILLE, N. Y.

The relics of the Indian consist of the numerous surface finds of arrow and spear heads, lost in the hunt and chase, and occasionally other objects as celts, gouges and ornaments. These, excepting the gouges, everywhere abound. Also must be included the weapons, implements and ornaments found on the various camp and workshop sites, and in graves accidentally disclosed, or by design. The surface finds from the hills and lowlands bordering the river are very numerous and in general are implements of an unusually fine workmanship for this section of the Atlantic slope.

Arrow heads of nearly every pattern of outline ever figured in archæologic works are found, but long, slim notched forms seem to predominate. Certain reaches of country, notably a group of slate hills just north of the river in the town of Glenville, have yielded a surprising quantity of arrow heads of beautiful form and finish. Among these occur unnotched triangular arrow heads of unusual size. This group of hills, really a long eminence of slates and shales of Hudson River age, is serrated by many gullies or ravines, some eroded very deeply. The Mohawks knew the hills as "Tou-ar-e-una," or "the place where we dwell together." This hilly region must have been an unusually choice hunting ground.

In the river valley proper, with its long reaches of flats broken now and then by ridges of sand or gravel, many indications of the presence of its former inhabitants have been noted. Besides the ever present surface finds, we have the many situations on bluffs near the bank, where implements were chipped—workshop sites. Also occasional village sites, graves and other indications. Some of these features will be treated in future papers.

[EDITOR'S NOTE.—Among many writers there has been confusion regarding the terms Mahican (or Mahickan) and Mohican. Dr. Wm. M. Beauchamp in "Aboriginal Occupation of N. Y.," assigned certain territory on either side of the Hudson in the vicinity of Albany to the Mahicans, while the Mohicans are located in Connecticut on the north side of the Sound].

Prehistoric Man in Egypt.

Human remains recently unearthed at Girga in Egyyt, consist of a continuous series extending backward over at least 8,000 years. The bodies are so well preserved, owing to the dryness of the atmosphere in the region and to the perfection of interment, that not only can the hair, the nails, the ligaments, be made out, but also the muscles and the nerves. In almost every case the brain also is preserved, and the climax has been reached in two cases where the eyes, with the lens in good condition, are present, and in others which show the limb flexures and great splanchnic nerve.

An Improvised Spectroscope.

To anyone interested in the subject the following instructions for making a small spectroscope at a nominal cost may be of use. The finished article, which will be nearly identical in theory and principle of construction with the modern instrument used for the purpose, will serve to demonstrate the method of working with a spectroscope, and will show the more conspicuous spectroscope phenomena, such as the bright line spectra of lithium, sodium, etc. The requisite materials for putting it together will cost about 2s. or 3s., and will comprise a prism, a small wooden box, a cardboard tube, and one of the small toy telescopes, a few inches in length, used by children.

Starting with the box, a cigar box will answer capitally; first remove the lid, then cut out from the middle of the bottom of the box a narrow slit, about 2 inches long and ½ inch wide. Over this slit place an ordinary microscopic 3 x 1 inch glass slide, cementing it down with coaguline, so that the slide will form a kind of window in the bottom of the box. On the outside of the slide now gum two pieces of dead-black paper, with perfectly parallel, sharp-cut edges, separated by a small space, so as to form a narrow slit. The top of the box must now be knocked out, the box itself stood upright on the table, and a candle placed in the back of it, with its flame on a level with the slit in the glass slide.

The glass prism, which can be purchased for a few pence at any optician's, is now mounted end up in a piece of cork, which is glued to a block of wood of sufficient height to bring the prism level with the slit. If one of the edges of the prism be now placed nearly opposite the slit, on looking sideways through the prism a narrow continuous spectrum will be observed. Viewed in this way, however, this spectrum will be too narrow to be of any practical use, and this is where the elaborate apparatus turned out by the optician evinces its superiority over the improvised article by the greater breadth given by it to this primary image of the spectrum on viewing it through a telescope magnifying it about eight diameters. An adaptation of this method can be utilized by taking a cardboard tube, about 14 or 15 inches in length, and inserting in one end of it the small telescope previously referred to. The whole cardboard tube can now be mounted on a block of wood or any improvised stand that will bring it to a level with the spectrum. If the open end of the tube is now placed close against the prism, in such a position that a clear view of the spectrum is obtained in the center of the field of the telescope and in sharp focus, the apparatus will be ready for use.—Drug Circ.

The New Barton Airship.

Out of the realm of the visionary and into that of the practical, airship construction is gradually coming. The kite experiments of Hargreave, the Australian, showing the lifting power of aeroplanes or flat surfaces when propelled against the air; and the practical airship or motor balloon tests of Count von Zeppelin, the German enthusiast, Santos-Dumont, the Brazilian, and others, have developed a considerable body of reliable data as to what can and what cannot be done in air navigation; and the rapid improvement of the gasoline explosion engine, providing large power with small weight, has made things possible which were out of the question only two or three years ago.

In Dr. Barton's airship the balloon is of the usual "cigar shape." It is 180 feet long, 41 feet in diameter and contains 156,000 cubic feet of gas, with a lifting power of about five tons.

Suspended below the balloon is a long car or frame built of tubing like a bicycle frame. The motor power is furnished by three sets of gasoline engines of 45 horse power each. Each set runs a pair of propellers, and it is expected that a speed of 20 miles an hour can be obtained. Three sets of aeroplanes are so arranged that by tipping them up or down the course of the machine can be directed upward or downward, and the lifting power is thus increased nearly 1,000 pounds. In an ordinary balloon ballast has to be thrown out when it is desired to let the balloon go higher, while the gas is let out to allow it to descend. With the Barton system it is not necessary either to carry any ballast or to waste any gas.

One great trouble with airships, just as with submarine boats, has been that their equilibrium could not be kept constant. If a man moved forward or backward, the machine would at once be thrown out of balance. The Barton balloon provides against this in an ingenious way, by having a water tank in each end, the two being connected with pipes and a constantly running pump. There is a pendulum regulation which, when the boat tends to tip down forward, for instance, makes the pump carry the water from the forward to the rear tank, thus equalizing the weight and restoring the equilibrium. This device works automatically. The balloon-ship is to carry enough fuel to keep it in the air 48 hours at a time.

A Greek Poem, 400 B. C. Found

An important Greek papyrus has been discovered by the German Oriental Society at Abusir near Sakkara in Egypt. It contains the dithyramb on the Persian wars by Timotheos of Miletus, a poet who lived about 400 before Christ, whose name only had been preserved. The poem is long and is the first specimen of that kind of poetry that has come to light. The manuscript itself is the oldest of all Greek papyri known.

Substitutes for Coal.

Small householders, dismayed at the price of coal, are making ready to use gasolene and coal-oil for cooking. Many families do their cooking with such fuel the year around, but the custom will be more widespread this summer than ever before. Edward Atkinson's cooker has never been popularized, but there are several other stoves in which the source of heat is a lamp, big or little, and almost every year a new oil or gasolene stove is patented.

Art students and others who have lived in Paris and practised the economies in which the French are specially skilled, are not to be alarmed by the prospect of a coal famine. With a pint cup and a ten-cent oil lamp the skilled economist in fuel can get a very satisfactory breakfast for two. In the pint cup the eggs are boiled in three minutes, and with the water that boils the eggs excellent coffee can be made in four or five minutes more. Thus with the expenditure of some fraction of a cent for oil, the breakfast is made and the coal famine goes on unheeded.

Coke is another substitute for anthracite in the open grate, and a very effective one for those who know how to handle it. There are many places where the price of firewood is such as to make that fuel available as a substitute for anthracite coal in the fall, when the whole house does not yet require to be heated night and day.

Hard wood at $6 or $8 a cord is perhaps cheaper than coal at the threatened prices. From the end of September to the middle of November a house in which there are neither invalids nor young children can be made wholesomely comfortable with hearth fires during the day. The cheer and health that accompany the wood fire would make the coal famine a blessing in disguise.

Peat, crude or prepared, will no doubt come into more use, as in the old countries.

Aluminum Nails.

For years, manufacturers have endeavored to find a cheap substitute for copper, particularly for use in making nails. Science and Industry in a recent number says: After many numerous experiments and trials, an alloy of aluminum has been made, with which nails, staples, and tacks can be made to compete with copper. Among other advantages claimed for the new material, is, that it is not affected by the weather, and will not deteriorate. It is to be noticed that this quality should recommend the nails for use in laying roofs, lining tanks, etc., and also that, as the alloy is non-corrosive and non-poisonous, the new nails ought to find favor among makers of refrigerators. When the difference in point of number and weight is taken into consideration, it is seen that aluminum nails are about four or five cents a pound cheaper than copper nails.

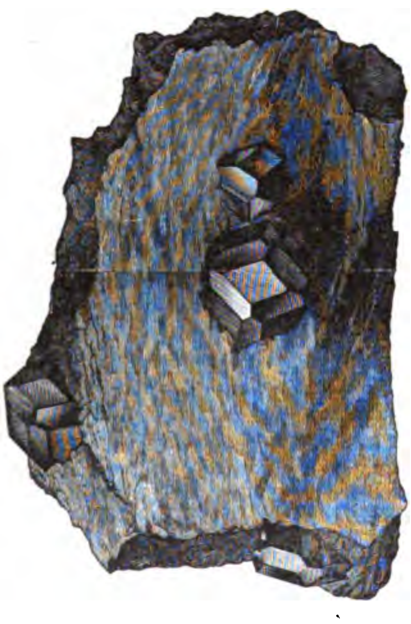
Minerals

[Edited by A. C. BATES].

Garnets.—The garnet group is both wide and interesting, and although considered a very common mineral by some, there are many varieties that are rarely represented in collections and which are unknown to most people.

Garnets are composed of calcium, magnesium, ferrous iron or manganese, aluminum, chromium or titanium, and with such a complex make-up, the variations are many in both form and color. The names given to some varieties are derived from their color, and the colors range from white to red, yellow to green, pink and black. The name garnet was long ago given to a particular shade of color, and the association of name and shade led people to believe that a garnet must be of garnet tint.

Garnets are divided into three groups, and each of these are subdivided according to composition. The (1) aluminum garnet includes grossularite, pyrope, almandite, spessartite. (2) Iron garnet includes andradite and ordinary garnets, and (3) chromium garnet, uvarovite.



ALMANDITE GARNET IN MICA SCHIST. FORT WRANGELL, ALASKA.

Grossularite is in color white, pale green, amber, yellow, cinnamon-brown, and rose-red. Cinnamon-stone, or essonite, called by jewellers hyacinth, is found in Ceylon. The finest and most brilliant groups of crystals are found in Maine.

Pyrope is a precious garnet of deep red color. The almandine is of lighter red or brownish red, and is the variety now most used in jewelry. Both these varieties are cut encabochon and are then known as carbuncle.

The alabandic carbuncles of Pliny were so-called because they were cut and polished at Alabanda; hence the name almandine, now in use. Pliny describes vessels of the capacity of a pint formed from carbuncles.

DODECAHEDRAL GARNET. RUBY, MT. SALIDA, COLORADO.

Pyrope and almandite are found in Bohemia and Bavaria, where they are also cut and from whence they are exported to many countries. Pyrope pebbles are brought up out of the earth by ants in the Navajo Indian reservations in New Mexico, and sold by the Indians to tourists at the railroad stations.

Large sharp dodecahedral crystals are found quite plentifully at Salida, Colorado. A garnet that weighed nearly ten pounds, and six inches in diameter, was found in 1885 in a excavation in West 35th st., New York City, and is now in the collection of the New York Mineralogical Club.

The andradite group includes a great variety of colors. The demantoid is an emerald green variety with a brilliant lustre and occurs in transparent rolled pebbles and in crystals in the Urals, and is known as "Uralian emerald." Melanite is black, either dull or lustrous. Topazolite has the color and transparency of the real topaz, but this variety is sometimes green.

Uvarovite is a calcium-chromium garnet, and is found lining cavities at several places in the Ural. A beautiful rose-pink garnet in large dodecahedrons occurs in the State of Morelos, Mex., imbedded in crystalline limestone with yellow vesuvianite. Thin slices of this material have been cut and polished for use as lantern shades and are effective as such, but expensive. Large polished columns may be seen in the New York Museum of Natural History.

Garnets altered into other minerals are common; the chlorite garnets of Michigan being the best known. The latest find of garnets was recently made in Norway. The crystals are of simple form, sharp and of good size, nicely isolated in a foliated gangue of schist, and are very attractive. A quantity of these specimens will be offered in this market this month.

Garnets are artificially obtained with difficulty. Garnet is mined extensively in North Carolina to be used as emery and as garnet paper. The best cabinet matrix specimens having sharp crystals of a rich red color imbedded in mica schist occur at Fort Mangel, Alaska. Rocks through which garnet is disseminated as a constituent part are very tough and heavy. There are a number of other varieties that might be here defined, but most of them are of minor importance.

Meteorites.—There are a great many specimens of meteorites in the museums of the world, but the history of the falling of most of them is unknown.

Mr. Mermod communicates to the Astronomical Society of France an account of a meteorite found not far from Lausanne, Switzerland, a short time after its fall. The instance is sufficiently unusual to demand notice. On November 30, 1901, four foresters were at work when they heard above them a noise like "the slow fire of infantry" or of "stones ground together." Some forty seconds later there was a whistling in the air not unlike the noise of "a wheat reaping machine," and the noise of a fall was heard. The men searched for the body causing the noise, and in searching found a branch of a tree lying on the ground some thirty feet away from its parent tree.

ALMANDITE GARNET IN MICA SLATE. TRAPEZOHEDRAL. READING, CONN.

The tree-trunk was marked with two fresh wounds in the bark and the meteorite that had rebounded was itself found about fifteen feet distant. It was still hot, about 50° Centigrade, 122° Fahrenheit, by estimation. It had broken in rebounding and three pieces of it were found. The meteorite weighed 705 grams (about twenty-one ounces) and its form was that of a polyhedron, almost pyramidal. Its surface was black and polished, covered with a patina half a millimetre in thickness. The specimen has been deposited in the Lausanne Museum. It was a part of a larger mass, evidently, for at various places in the vicinity the noise of an explosion was heard by different persons, some of the places being twenty miles distant from the site of the fall.

Molybdenum.—The ore of this metal, called molybdenite, is mined chiefly in Arizona and New Mexico, together with the deposit found last year in Washington, from which some excellent hexagonal crystals have been secured. Recently, two large deposits of this ore were discovered in the south bend of Gold Hill Mountain, Utah, which will add another important mineral to the long list furnished by that state. The production of molybdenum in the United States for 1900 was 32,000 pounds. It is a brittle, hard, silvery-white metal, difficult to fuse. It was long confused with graphite, which in the ore it much resembles. Molybdenum alloys with tin, lead, iron, copper, silver, gold and platinum, rendering them harder to melt, more brittle and whiter in color.

Ellenville Mines.—The old lead mines at Ellenville, N. Y., so long and favorably known to mineral collectors because of the quality of quartz crystals found there, is again being worked along two veins of zinc ore. The large, heavy slabs of metaliferous gange covered with short crystals of clear quartz ore as of yore, are thrown out with each blast. The new owners hold good specimens at fancy figures, but their notions of value are likely to change as the specimen pile grows larger.

The trap-rock quarries at Great Neck, N. J., are yielding some fairly good specimens of quartz, datolite, heulandite and prehnite.

Gravity Cooling Machine.

The gravity apparatus for cooling dwellings, invented by Prof. Willis L. Moore, Chief of the Weather Bureau, patents for which were recently secured, was placed in operation for public demonstration recently. The machine looks like a cylinder stove, and the inventor says will in time come to be considered as essential to the comfort of a dwelling in summer as heating apparatus in winter. Prof. Moore says that the cost of cooling a given space with his machine is approximately the same as that of heating the same space by means of a stove or furnace. Besides this, the different uses to which the machine may be put are unlimited. He expects it to prove of great value to hospitals, particularly for reducing the temperature of wards in which fever patients are confined and in addition to its use for cooling residences and hotels, he says it solves the problem of individual cold storage.

Prof. Moore's invention, in addition to reducing temperature, washes, cleanses and renders the air dry and healthful. Hot air, filled with dust, is taken into the machine at a temperature of nearly 100 degrees and expelled almost instantly at a temperature of thirty degrees and with its relative humidity lessened by more than half. The machine operates, as its name implies, on the principle of gravity. That is, it makes use of the difference in weight between air at a high and at a low temperature. It is, moreover, automatic. It requires no motive power, and is self-adjusting. When the weather is very hot the machine works faster than when it is only moderately warm, and when the weather is temperate, the machine ceases its operations altogether.

Prof. Moore says that as soon as the foreign patents are granted he will make public the formula of the composition with which the machine is charged. He said, however, that the composition contained no ammonia, nor any of the usual ingredients of ordinary freezing mixtures.

DOES THE MIND CEASE GROWING?

BY ROBERT MORRIS RABB.

The mind and the body, in our present mode of existence, are closely related. They have much in common. How mind is clothed upon with flesh is a constant mystery to psychologists. This being true, no one has ever been able to describe the tie that binds mind and body together. Our flesh has certain capacities which reach out toward mind and makes its conjunction with mind a possibility. Likewise mind has hitherto undescribed capacities which stoop toward flesh and share with flesh this possibility of union.

The Child.—At birth, and for some weeks following, mind is in a certain state of inactivity. What the state of mind really is, why it is inactive, we do not know. Certain animals come into the world with a marvelous store of instinct; or, at least, a few hours are sufficient to develop in them this instinct. Their transition from the prenatal condition to the larger world is marked by a brief surprise; and then the creature is at home. Humanity is provided with no mental activity at birth and with very little instinct. The first gleams of intellect show themselves in the child's attention, or in its "noticing things." Some one has said that when a mother first secures her child's attention by pointing her finger at an object, in her hands rests the supreme task, for years, of educating mind. Another has said, "The real birthday of my child is when he says 'I.'"

After the dawning of intelligence a parallel growth of mind and body ensues. In some children the growth of mind is very rapid; in others, it is retarded. The bodily condition may have much to do with this, though the explanation seldom lies, in full, at this point. Some children find it harder to get on their feet mentally than others. The first five, or even seven years of a child's life give little promise, in some cases, of what the mind is capable. Sometimes the child has failed to get his nervous system well in hand, and is awkward; most of his strength goes to growing; sometimes the proper mental stimulus is not enjoyed by the little fellow, and we call him a "backward child." He may not be permanently backward.

The laws controlling mental and bodily growth in children are worthy of more careful attention than parents generally accord them. There is a normal growth of the body, secured in the way of health; there is also a normal growth of the mind, secured in the way of patient training. The danger lies here in two directions: there may be the mistake of too much training; or there may be no training. Which is the graver sin? I do not set myself to decide, beyond saying that I very much fear that overtraining is a supreme sin against childhood. The regulation of mental stimuli, the introduction of such stimuli at the right juncture, are extremely important conditions in child-life. And it is not possible to lay down explicit rules in such matters; for children differ from each other from birth. On behalf of all young children it is proper to plead that they be kept well, if possible, and be guarded against excitement due to fear. Excitement due to joy is generally a bless-to young and old life alike.

Differences in Mental Capacity. — It hardly admits of denial that men are born with differing gifts. Heredity cuts a considerable figure in this matter. But heredity is not a fatality; for much that is inherited may be improved; while much can be suppressed, or possibly it should be. Until the world grows vastly better, most children will find the gifts of heredity quite an admixture of desirable and undesirable things. Alas, how many sons and daughters born to men never realize that heredity may be an evil to be fought against and conquered nearly every day in a life-time! But we should never admit that our individuality, though it is beset with strong limitations, is necessarily mastered by heredity or by circumstance. A large part of education is a standing rebuke to our weakness at this point; and we are certainly unprepared to concede that liberty of choice does not belong to us as truly as it ever belonged to our predecessors.

Speaking generally, there is not so wide a difference among men in mental capacity, as is commonly supposed. Of course, I must rule out cases of physical and mental degeneracy under which disadvantage whole nations sometimes labor; and exception must be made in cases of mental dullness from birth. These cases are comparatively few. Most of us are born with about the same mental capacity. The size of the brain does not differ very widely among men. In most men the brain, including the network of the nervous system weighs between three and four pounds; and instance after instance is recorded of men of splendid mentality whose brains were under the average weight. The question of mental capacity is not settled by the bulk of brain; still I am far from maintaining that there can be large mental capacity associated with a brain much under normal weight.

The difference in mental strength so noticeable among men is, I believe, far less traceable to native capacity than to a wilful lack of training. Most men can be educated if they really care to be. Even poverty is daily shown to be no real impediment to securing an education. It is, after all, largely a question of will as to whether the mind shall be developed; for, taking a mind of moderate gifts, can anyone set a limit to that mind's capacity for improvement? Every attainment it makes, so far from proving the last one it can make, prepares the way for some other and larger attainment. All men could not be poets; but more men could be poets than are. All men cannot be scholars; but multitudes could be scholars if they chose to be, and yet are not and never will be. Let the mind master one thing thoroughly, and there goes with that mastery a strong confidence that it can master just as thoroughly some related subject, or some new subject.

What is Maturity of Mind?—The mind is an organic unity. It has a life of its own. The body is an organic unity possessing a life peculiar to itself. The body reaches a maturity before the age of twenty-five, in most individuals; though some persons grow in height after that age. At what age does the mind reach maturity? Certainly not at the age of twenty-five. Just what do we mean by the maturity of the mind? Do we mean that the capacity of the mind reaches its destined limit? Experience does not warrant the conclusion. Do we mean, when speaking of mental maturity, that the powers of mind are as fully developed as we can hope to see them during lifetime? This cannot be true, as a matter of necessity; it may be true as a matter of fact. Finally, in speaking of mental maturity, do we mean that the habits of mind are so fixed as hardly to admit of any departure from them? Of most persons that may be true. And where the habits are unfortunate this fact is calculated to fill us with alarm. At about thirty years of age, most persons seem to have reached this kind of maturity. The mind tends to establish habit in all its operations. But to speak of mental maturity, in a strictly definable sense, as we speak of bodily maturity, is unwarranted by experience; or to mean by mental muturity that the judgment is as safe in its processes as it ever will be, is not warranted, for in painstaking men the judgment increases in precision with the enhancement of the store of experience. The fund of common sense ought to be always enlarging whether it is or not. It is better to leave this idea of mental maturity just as indefinite as the idea itself forces us to leave it; for changes of the most radical nature are constantly taking place in mental history after the age of thirty, and the established mental habits manifest at that age either minister to a new mental life, or become practically abandoned as non-usable.

The Constant Temptation to Regard Mental Life as "Fixed" at the Age of Thirty.—As I have already stated, mind tends to establish habits as modes of its operation. These habits begin very early in life; but they are more subject to disturbance and absolute abandonment early in life, than they prove to be after thirty. And as everyone is aware, who has conscientiously made the trial of it, a fixed habit assumes the strength of "second nature." It is not at all infrequent that we find persons absolutely skeptical as to any possible radical changes in mental or ethical character after the age of thirty. The skepticism is based on a partial induction, and is, therefore, unsound.

We are tempted to regard our mental life as "fixed" at thirty, for the reason that we regard our mental habits as "fixed" at that age. And we regard our mental habits as "fixed" at that age, because we are conscious of a lack of will force sufficient to break those habits up. As we advance in years, it must be confessed, liberty of choice in this matter either decreases, or our backwardness in the use of that liberty increases, which amounts to the same thing.

Mental Growth and Mental Development are not Necessarily Identical.—Growth is increase in size in material things, and enlargement of scope and compass in mind. There is a wide difference between the compass of the mind at the age of seven, and the compass of the same mind at the age of twenty; though the mind at the of twenty may be undeveloped. It has enjoyed growth but not development. Development is a complex thing, and brings toward perfection the qualities of mind which growth fails to bring to their possible height of improveableness. The ability to reason with care is the result of development of the logical functions of mind. Long and careful training, involving a complexity of mental acts, is necessary to a thorough development of the logical powers of mind. It is the development of mind, secured at extreme cost, that frightens away multitudes from higher education. And when we come to the real test of mental strength, the world at large is forced to admit that there is a wide difference between developed and undeveloped mind. Higher education in any department is intricate and calls for prolonged effort and real pains; but the result is clear and certain: the development of mind.

In asking the question, 'Does the Mind Cease Growing?' I did not design to separate between mental growth and mental development; for I had specifically in thought growth through development.

Does the Mind Cease Growing?—Mental life usually increases in volume with the increase of years—that is, until the vital forces of the body suffer weakening in age. And many an aged man not only holds his own against the weakness of age, but maintains a steady growth in mental life. Is it, then, a matter of will with the aged as to whether they persist in growth? Not always: but no doubt more generally so than aged people imagine. Indulgence in weakness of any kind, and at any time in life, tends to become habit. How much more is this true of the man who feels the vital forces of the body all relaxing under the burden of years! Mr. Gladstone's battling with the weakness of age was an example of what a man can do after he has reached sixty-five. He simply would not give down and live in the past. But Mr. Gladstone probably kept himself well as a religious duty.

While the mind increases its store of knowledge as the years come and go, it may practically cease growing (in the sense of developing) before the age of twenty. What is called "arrested development" in mental life is simply the mind's ceasing to exert its powers in some way honoring to those powers Cases have been known of men passing through college as "first honor men," whose minds afterwards suffered a lapse into "arrested development," even where no physical failure appeared to account for this. A loss of energy and of mental ambition seemed to be the explanation.

So long as memory and ability to reason characterize mental life, the mind may continue to grow. I do not mean to hint that you can separate memory from ability to reason, or vice versa. All knowledge is conditional upon memory. All accurate knowledge, all accurate reasoning, are conditioned upon accurate memory. If the mind is capable of possessing itself of something new, that mind is capable of growth. When it loses this ability it not only ceases to grow but suffers a lapse into weakness. A new book in history, literature, science, economics, religion, thoroughly read and fixed in the mind results in mental growth, whether it is read at the age of fourteen or at the age of eighty.

Mind grows by means of mental stimuli—something must rivet the attention, provoke the reasoning, contribute to imagination, touch the conscience; then growth follows. The truth is, every ordinary man carries within him a mind with capacities which may be indefinitely improved. And is not the period lying between the ages of twenty-five and sixty-five the period naturally covered by the mind's best activity? The secret of the best mental life lies in the constant use of the best mental stimuli.

Penny-in-the-Slot Directory.

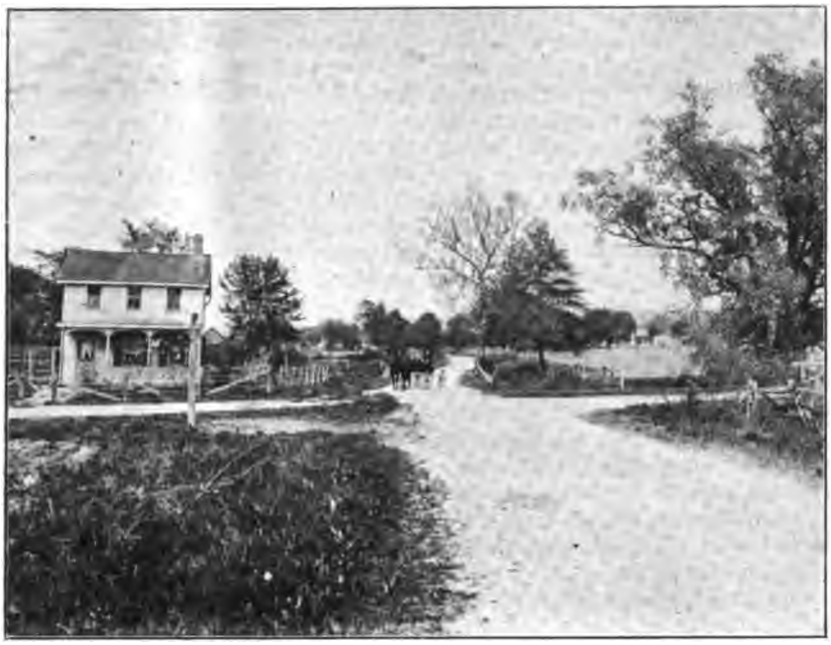
A new modification of the scheme is now on the market, in which the book, instead of being placed in a box whose cover lifts up, the covers of the book are held in rigid supports which are hinged to the top of the stand. A penny is dropped in the slot, the knob is pushed, and the directory can then be consulted. After the desired address has been obtained, the book closes and locks automatically.

Photography

CLOUDS IN PHOTOGRAPHS.

BY D. P. D.

One of the best features adding to the beauty of the landscape is the clouds in the sky. This is a feature so strongly brought out in oil paintings, and the various hues lend opportunity to the skill of the artist. While every amateur photographer is cognizant of the fact that distant objects require very short exposure, many plates have been spoiled in trying to get the clouds in the negatives along with the rest of the landscape. That these attempts always result in failure is obvious. Either the clouds will show and no landscape, or, as is generally the case, the landscape well brought out, and no clouds. This follows, as a matter of course, for each requires a different exposure. We must, then, conclude that all photographs showing faultless detail and having, also, clouds in the sky, must have been done by some special means.

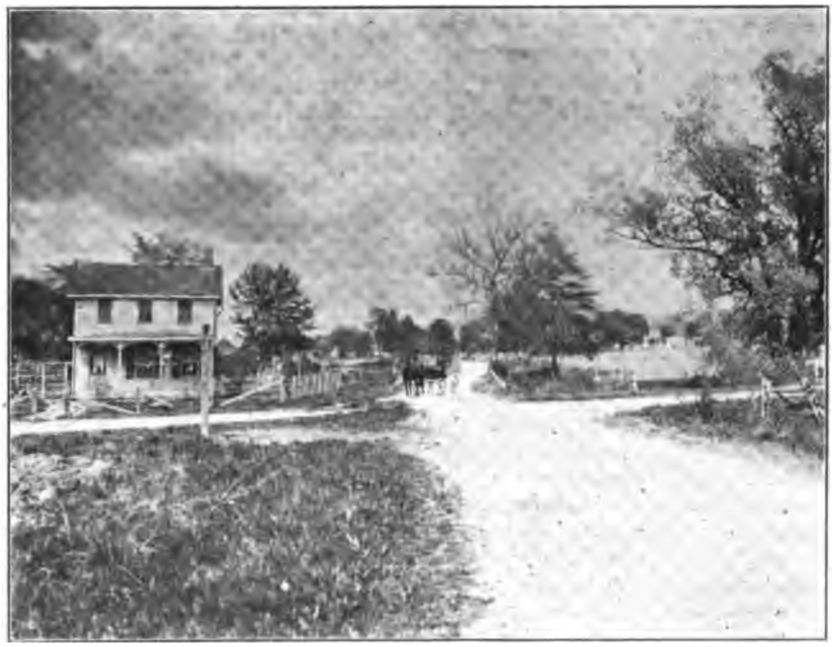


AS USUALLY TAKEN, WHITE HIGH-LIGHTS.

Formerly this has been done by introducing a "false cloud" in the printing frame. These "false clouds" are nothing more or less than a celluloid film so manufactured as to have portions of varying opacity resembling true clouds. While this make-shift may be the means of producing a fairly attractive picture, it is artificial, not being a true photograph, and therefore not suited to the wide-awake amateur of to-day.

Look at the two reproductions shown on this page, both the same view, one taken immediately after the other, but only one showing clouds in the sky. It will probably be interesting to the many readers of POPULAR SCIENCE NEWS to know how this may be done. The explanation is simple; the clouds are taken on one plate, the landscape on another, and the two are used in making the print. The method to pursue is as follows:

First secure the cloud negatives (snapshot with wide stop) by pointing the camera up at the sky when clouds are plentiful. The light fleecy variety are, as a rule, better suited to the average picture. It is well to have a number of these cloud negatives, so as to have a variety from which to choose. Let us assume that these cloud plates have been exposed and developed. It is much easier to use a good developing paper, velox for instance, which may be used by lamp or gaslight.



FROM SAME NEGATIVE, SHOWING CLOUDS IN SKY.

After determining the landscape negative to be used, choose a cloud negative best suited to it. Place the latter in the printing frame, shade the portion below the sky line by a slightly moving cardboard and expose to the light. When sufficiently exposed, replace the cloud negative with the landscape negative, covering now the portion above the sky line, giving, as before, a slight movement to the cardboard in order to avoid a distinct line, and expose according to the density of the negative.

Upon developing, the print will show a surprising improvement near the plain high lights of the ordinary operation. A very little practice will enable the photographer to produce an artistic picture from negatives promising but mediocre results, and this method is satisfactory for the reason that everything shown in the finished print is a real photograph, and not an imitation.

PHOTOGRAPHIC NOTES.

THE camera market has stiffened a little this year. Cameras that were sold as shop worn a year ago for half their original price, have increased 25 per cent. in value.

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Two years ago one of the larger camera producing concerns began the manufacture of a camera so small that when folded it would fit the pocket. At once other establishments took up the idea and followed it with varying success.

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THE dealers all assert that there is no Camera Trust. But certainly there is a remarkable uniformity between the prices asked for cameras of the same grade manufactured by different concerns.

Various Topics

LANGUAGE BETWEEN MAN AND ANIMALS.

BY E. A. MATTHEWS.

The dictionary maker is abroad in the land, and the shelves of our libraries begin to groan beneath volumes written about the origin of the language. Not so well known, however, is that language used to control "Our Little Brothers of Silence," the words employed between man and those dumb creatures who cannot answer, although they understand us.

The subject is full of interest to the lover of animals. Dogs and cats, cows horses, chickens, sheep and pigs, — are they not members of our family, the dumb ones of God's special care? Have they not always been, as now, a part of home life? Did not our ancestors before the dawn of history care for their animals, and love them next to their children? Perhaps a little study of certain common words will aid in answering these interesting questions.

Some of them are the names by which our ancestors called the animals themselves. Some are Sanscrit, or early Indian words, some are Greek, some Latin, some Teutonic, some Old English words, long since obsolete. Max Muller, in "Chips from a German Workshop," says: "The commands we give to the horse, and our call to the cow, are the same used by the prehistoric men of our race. In all probability, the Arab calls to his camel in the same words now, as in the days of Abraham or Noah." No doubt many ancient names of animals exist to day, somewhere on the earth, unchanged.

The dog is nearest to man, and understands his speech better than all other animals. Perhaps because of his almost human intelligence, there is no special call, or particular word of command for him. Whenever he appears in the long panorama of human history, we find him always the same, in an almost childlike relation to the family. The story of Argus, that typical dog of the wise Ulysses, might be told of many of his fellows to-day. When Ulysses returned, weary and travel-worn after years of wandering, "tossed about much on land and sea," he found himself forgotten, a stranger in his own house, unremembered even by his wife. But Argus, the faithful watch-dog, heard the "long silent voice of the master, drew himself near, fondly licked his feet," and with one bark of welcome, and whine of feebleness, died of joy—breaking his faithful heart with the effort to welcome him. Such a creature cannot be classed with common brutes, but must be talked with as from man to man. There is one word, used by every race, and understood the world over; the exclamation "Sic'em," which doubtless means "seek 'em"—and comes from the Sanskrit *sak*, meaning to chase, or follow.

In talking to the horse we find the word ho, or whoa, used alike all over the world. It is supposed to be the interjection *öhe* of the Greeks and Latins, a simple call to attract attention, another form of which was from Sanscrit *yu*, meaning to hold back. *Ho* is Old English for hold, and is still used in that sense in many countries, and is considered to be also the Aryan word stop. The words that guide the reins are different in many languages, because the teamsters do not always guide alike. The Englishman and American say gee and haw, but as in Great Britain the horse must keep to the left, their meanings are reversed. The German says *hott* and *hist*, the Frenchman, *hue* and *dia*, the Spaniard, *cho* and *ven aca*, the Italian *gio* and *veney*, all meaning about the same, but of different origin. But when the farmer's boy says "cope," he uses an old Sanscrit word which means come.

The whistle to the horse is the same in every race and also calls the cows. The child who pets her calf and calls it "bos," or "bossy," uses the Latin name of its race, almost the same in Greek, but when she says "co-bos" she uses the Sanscrit verb *gu*, meaning to low as a cow. The milker says *soh* to the cow, which comes from the Sanscrit *sagh* or *sah*, meaning to remain, or keep still.

The shepherd calls "ca-day! ca-day!" as he enters the field, and the sheep come, bleating and stumbling, to answer him. This call comes from the Old English *cade*, a lamb, meaning also, tame, or gentle. It is curious that this call, like many others, is meant for the very young of the flock.

The primitive name of the hog, in early English at least, is chuck, hence woodchuck, or wood-hog. This is used in some countries as a hog call, but is not universal. The old-fashioned western and southern cry "Pig-ooy! Pig-ooy!" has no ancient tradition, but is again a call for the young. Pig is a word found in the Teutonic languages, meaning the young of all animals, so when the mother repeats the nursery rhyme, "This little pig goes to market," she means, although she does not know it, "this little calf," or "this little colt," just as much as the small member of the pork family. The queer exclamation "st'boy," is used all over the world to drive away the hogs.

The fowl call, "chick!" "chick!" is as old as the chicken itself, being the Sanscrit *kuk*, the name of the domestic fowl, clearly imitated from the older verb, *kak*, to crow, or cry, from whence the word cackle. When the little country girl cries "shoo," to scare away the chickens, she uses the same word as did Penelope, that model of Greek housewives, and she inherited it from her Sanscrit forefathers, who said "su," meaning to hurl, or drive.

We must not omit the old world and world-wide names given by children to the cat or dog, when they say "the meow-meow," and "bow-wow." These names were given by the oldest races and continue unchanged to-day. The word puss is said to be an imitation of the spitting of the cat, from the Hebrew phis. Kit is but a variation of the word cat, and the word of command, "scat," is a combination of hist and cat. Some authorities, however, say it is from the Sanscrit skat, meaning, to scatter.

This is a subject that grows upon one, and it is to be hoped that some Max Miller of the animals will one day tell us more about it. We know that in the pastoral days, when man and his flock lived together, and the camel and ass were counted as children, they understood each other, and had a mutual affection, almost unknown to-day. Yet these dumb creatures share our mortal lot; "the whole creation travaileth together." The language that unites us should be full of interest to every human being.

A LESSON OF THE DROUTH OF 1901.

BY H. A. CRAFTS.

Doubtless, to the person living in the humid regions of the east, the idea of any extensive system of irrigation, either by public or private enterprise, looks like an impracticable, if not a foolish, thing. Possibly this person is not so culpable in his ignorance as some living in the arid west might think. He has had few, if any, opportunities to study the subject. His knowledge, if he has any on the subject, has probably come by reading; and irrigation is not a subject that can be made interesting to the general reader by simply descriptive writing. If he could have the thing practically demonstrated to him, he would very likely take a greater interest in it.

Object lessons are almost indispensible in the inculcation of the theory of irrigation, and one has already presented itself. The man who is compelled to buy corn, potatoes, apples, pork, etc., at the present time, has the damaging effects of last summer's drouth in the middle west repeatedly impressed upon his mind. Where the pocket is touched the mind is pretty sure to receive a perceptible jolt.

The possibility of the exhaustion of our food-producing lands, and a consequent shortage of provisions, has been time and again ably discussed by our economists; but the possibility of a famine from a sudden and widespread drouth does not appear to have largely entered into their calculations. Our soil resources and area seem to have so dazzled the minds of our savants that their eyes have been blinded to possible disastrous contingencies. The one to which attention has just been called ought certainly to engage passing thought. When a drouth, short in its duration and limited in its extent, can so seriously affect the prices of so many of our staple commodities, it would be well to inquire as to the consequences of a drouth extending over large areas and throughout a series of years. Here are some prices prevailing in Colorado during the month of November, 1901: Corn, per hundredweight, $1.32, wheat, $1.10, potatoes, $1.25, oats, $1.25, barley, $1.25, lard, .15 cents per pound, and other pork products in proportion. These are products taken almost at random, and they by no means include all affected by the drouth. The quotations, too, are taken at an early stage of the season, with chances of further advances before another harvest can possibly be garnered.

Quite naturally, these high prices inure to the benefit of the Colorado farmers. To be sure, the farmers do not attempt to raise much corn, but what they have raised the past season is worth just so much more by reason of the drouth in Kansas, Nebraska and Missouri. But of other crops they have gathered bountiful harvests. There is an absolute bonanza in Colorado potatoes, and farmers who bought farms in the spring of 1901 and planted a fair acreage of potatoes, are harvesting sufficient tubers to pay for the cost of raising the crop, and the entire purchase prices of their farms, besides.

And all this has been accomplished through the benefits of irrigation; for the drouth in fact extended to Colorado. The summer was hot and dry, but there was a general abundance of water for irrigation; hence the prevailing era of plenty and remarkable wave of prosperity that has swept over the farming sections of the state.

Do not these conditions call for a broad and liberal study of our economic resources? Why should the east view with indifference, if not with contempt, the question of government aid in the reclamation of the arid west, when it might mean, at no very distant day, the country's salvation from dire want, if not absolute famine? At least one-third of the total area of the United States might be classed with the arid lands. In fact there is no dearth of lands; all that is needed is a water supply that shall be the means of their partial reclamation, and of creating a safeguard against famine by drought.

Even in its comparative advanced stage, the system of irrigation now in operation in Colorado, will some time be looked upon as having been crude, clumsy and wasteful. Methods will doubtless be devised whereby the same water, now in use, may be made to afford ample irrigation for double the amount of land. Then the land actually under cultivation may, by more methodical and scientific methods of cultivation, be made to produce double the amount per acre that it is now producing. Again, the water supply in certain irrigation sections, which now appears to be fully utilized, may be doubled in its quantity by proper conservation.

If these things are possible, the imagination can hardly conceive of the vast results that could be obtained from a utilization of the great water supply of the northwest, enormous in its proportions and unfailing in its flow. Should the government ignore this question, when it may mean the saving of widespread suffering if not death from actual starvation? It might mean a two-fold saving, also; a saving from flood as well as drouth. With canals of sufficient length and carrying capacity, immense volumes that now annually devastate the Mississipi valley might be turned aside and made, not only to apply directly to growing crops, but to fill great storage reservoirs or inland lakes where vast quantities of water could be held in reservoir for use either on land newly reclaimed, or, in the event of a shortage, in the general supply.

COLOR LORE.

BY LORA S. LA MANCE.

There are but three primary colors as pigments, red, yellow and blue. The other four colors, green, indigo, orange and violet, shown in the spectrum and the rainbow, are in art formed out of a combination of the three primary colors. All others, brown, pink, buff, lavender, etc., are based upon and derived from the seven foundation colors.

Red is the color of the rose and the poppy, of the ruby and the garnet, of the flame of fire, and of blood, the life of the body. It is the first color that the infant notices, and the last that is distinguishable at the fading of the day. It is the color that sets the bull to raging, and the turkey gobbler to fighting. It is the color that all savages, all children, all voluptuous natures, and all oriental temperaments, like best. The Turk wears a fez or skull-cap of red; the cardinals of the Catholic Church wear robes of that deep hue known as cardinal red; red clothes Great Britain's soldiers, and stripes our country's flag. Two bars of red crossed upon a white ground is the familiar badge of the Red Cross Society, signifying the courage of war pledged to the principle of mercy. Red is universally regarded as the color of warmth and courage. A red flag is an open defiance. The day after the battle of Bunker Hill, General Putnam caused a blood-red flag to be displayed as a challenge to the British. On this incendiary flag were the words "An appeal to Heaven." The old warrior could not have given a more expressive token of his fighting mettle.

Yellow, red and orange are the three bright colors. When intense, yellow is the most dazzling and brilliant of all. It is the color of bright gold, and of the blazing sun. It is the color of ripe corn, and of the wheat-fields at harvest time, when the bread of the world is being garnered in. For these reasons it is counted as a symbol of wealth and power. Yellow is the color of those household pets, the canary and the goldfish, and of those grateful tropical fruits, the banana and the lemon. It is the badge color of the equal suffragists, who believe the golden rule was meant for all human-kind, and not merely the masculine half of it. Yellow is the mourning cloth of the Egyptians, and the sacred color of the Buddhists, which their priests must wear in robe or cloak. It is a terrifying color when we see it in the form of a floating yellow flag, for it tells then of pestilence near at hand. One of the most fateful and spiteful of rivers, crooked and tortuous, constantly breaking into new channels, or inundating its banks, is the famous Yellow River, of China, itself the "yellow empire." And of all diseases, none is more dreaded than yellow fever, the "Yellow Jack" of the tropics.

Blue is held to be the color of truth and constancy. It is the color of the sky, the lake and the sea. Those who secure the prize, or win the race, wear a blue ribbon in token thereof. The oldest and most exclusive families are spoken of as "blue-blooded." Blue is one of the most becoming colors for the blue-eyed maiden to wear, and she, herself, never lacks for admirers. Our soldier boys wear the blue, and it forms the field for the stars of our flag. It is called the coldest of colors, and the hardest for artists to manage successfully. Nevertheless, next to red, it is the most popular color.

Orange occurs the least often of any color in nature. It is an exceedingly warm, rich color, gorgeous in effect, but a little goes a great way. We would not wish to part with the glowing tiger lily of our gardens, or the red-gold of the luscious orange, or the brilliancy of a flaming sunset; yet it is the color that we tire of soonest, that is the most trying to wear, and the hardest to combine harmoniously with other shades. Orange is the badge color, also, of the Orangemen, or Protestant Irish, and its wearing has often precipitated a lively scrimmage among our hot-headed brethren of Erin's isle.

Green is the paradox among colors. The most honored, and the most despised. It is held to be the symbol-color of inconstancy, of fickleness and of jealousy. No bridegroom, no bride, would choose green as the color of his wedding suit, or her wedding gown. It is thought so baneful physically, that many will not wear green garments or sleep in a green papered room; and it is a remarkable fact that nearly all green dyes are intensely poisonous. We term an awkward, ignorant person "green," and call unripe and unwholesome fruit "green" also. On the other hand, any of us would like to have our pocketbooks stuffed with greenbacks. A green turban among the Mohammedans is a badge of honor that its possessor is fanatically proud of, for it denotes that the wearer is descended from Fatima, the daughter of Mohammed himself. Every patriotic Irishman is ready to swear by the Emerald Isle, and, if a Catholic, to don on St. Patrick's Day the green ribbon that is the badge of Ireland's patron saint.

The first lady's dress ever worn, and the first gentlemen's suit ever made, were both of green material, a fine dark shade of fig-leaf green. An odd thing about green is that nature uses it in summer in ultra-lavishness, but only as leafage, or such lowly blossoms as those of the grasses or sedges. She abhors it for flowers, producing a green-petaled flower only at rare intervals and under protest. And save in the greenish anger of an approaching cyclone, or in some evening skies, nature never paints her sky or clouds with green, though she uses every other color in her sunset and sunrise skies.

The dyer's art deals with indigo, said to be the first color produced artificially. When a person has a fit of the "blues," his feelings are of the deepest indigo. England clothes her sailors in indigo or "navy blue." This deep shade is the color of storm clouds, and of waters lashed by a gale. Fittingly enough, the old Romans took this color of terror and storm as their mourning color.

Violet is the symbol of sadness. In Turkey it is the color of full mourning. In America and Europe it is used to lighten black, in the sense of secondary mourning. This hue is the color of the violet, the most loved of flowers, and, as the emblem of the great Napoleon, the pride of the French nation. Violets are seen on French bonnets, in French gardens and in French drawing-rooms. The Empress Eugenia, then Countess de Gusman, delicately made public her betrothal to Napoleon III by appearing at a grand ball in a superb gown of rich violet elaborately decorated with clusters of those dainty flowers. Violet or purple is one of the richest of colors, and "royal purple" could at one time be lawfully worn only by those who wore a crown. The old royal purple, or Tyrian purple, was produced from a small shellfish of the Mediterranean Sea. Each tiny mollusk produced but a single drop of this purple dye. As these small shellfish became thinned out, while the demand was greater than ever, the price of this almost unprocurable dye rose until enough to color a single pound of silk or wool cost more than a hundred and fifty dollars. Modern chemistry produces the same rich color at the cost of a few cents!

Neither white nor black are colors. When all the colors are united in a single ray of light, it becomes white. Thus white stands for fullness or completeness, also for peace and purity. A white flag is recognized as a flag of truce all over the world. A white ribbon is the badge of the greatest temperance society the world has ever known, that of the W. C. T. U. The Chinese use white as their mourning color, but the rest of mankind use it on the occasions of weddings and feasts, and school-girls graduate in white. Bonar says:

"The babe, the bride, the quiet dead,
Are clothed in white raiment all;
Wear the one badge, the one fair hue,
Of cradle, shroud and bridal hall."

Black is the color of negation, for it is caused by the absorption of all the rays of light. Black stands for woe, for trouble, for humiliation, evil and error. In the far East it is the badge of servitude and degradation. With us it is the symbol of mourning. The sorrows of the ages have been heaped upon the black man. The black plague is the most terrible pestilence that ever raged. The black flag of the pirate means robbery and death. The witch's cat was believed to be black without a white hair on it, and the Devil himself is painted black. So that superstition, prejudice and custom unite in making black the scape-goat of the colors.

Yellow Fever and the Mosquito.

Some curious and even amazing information comes from Havana as to the disappearance of yellow fever through the eradication of the mosquito. The average number of deaths annually from yellow fever in Havana, has, through a long series of years, ranged around 300. In the year that followed the beginning of the war on mosquitoes there were but five. The idea that these "terrors of the night" are the sole carriers of the yellow scourge is not new.

It was put forth definitely by Dr. Finlay at least twenty years ago. Even now it is doubtful if it would have received any attention from medical men or the health boards if it were not for similar results in another field. The work of Major Ronald Ross, of the distinguished Dr. Koch, and especially of an untiring band of Italian bacteriologists, has conclusively demonstrated that the mosquito is the infecting agent in malaria, intermittent fever, and all its varied forms.

A year ago the army authorities at Havana threw aside the usual (and useless) precautions against yellow fever, and began a merciless campaign for the extermination of the mosquito there, with a view of testing Dr. Finlay's theory as to yellow fever. The methods were simple and direct. Every yellow fever victim was isolated from possible contact by means of netting, the house thoroughly fumigated, and the insects, so far as possible, killed off. Bogs and stagnant pools were filled up. Kerosene was employed freely where filling was found too expensive.

Ponds were stocked with surface feeding fish, which ate up the larvæ as soon as laid. The result is indicated above. In another year yellow fever will be as little known in Cuba, and we hope in all the rest of the world, as smallpox is in well-bred places now. Concurrently with the disappearance of the chief scourge of the tropics will go the second—malaria. The variety of mosquito which carries the one disease does not carry the other. But the two may breed in the same pool; the only safe way is to kill all mosquitoes.—Harper's Weekly.

Hall's Journal of Health

Founded by Dr. Wm. M. Hall, 1854.

THE NATURE AND VALUE OF PAIN.

BY EDWARD C. HILL, M D.

The seat of all pain is in the brain, although the brain is itself nearly insensitive. The sensory nerves carry impressions to this organ from the internal and external surfaces of the body, and in a less degree from the bones, joints and deep tissues generally. The afferent nerve fibers of common sensation are separate and distinct from those of touch, temperature and special sense. It is the excessive or abnormal stimulation of the plexiform nerve endings of common sensation that ordinarily gives rise to the sensation of pain.

In anesthetic conditions, whether it be from organic paralysis or from hysteria, the nervous connection between the central sensorium and definite areas of the periphery is lost or suspended, so that a needle may be run under the nail or the skin be burnt with a red-hot iron, without the subject suffering any pain.

The perception of pain is commonly referred to the extremity of the affected neuron, though the exciting cause may be, for instance, pressure on the nerve in its course by a tumor or scar tissue. Thus the sciatic nerve runs from the buttock to the heel, and in sciatic disease pain may be felt only at the termination of the nerve branch in the heel. Disease of the spine is often manifested first by pain at the spinal nerve endings in the front part of the abdomen. Again, after an amputation, the transected nerves sometimes become bulbous and painful, the pain being referred curiously to the portion of the limb that has been cut off. A moderate irritation is frequently noticed, not at the site of the causative lesion, but at some other more sensitive area in the distribution of the given nerve; thus an early manifestation of hip joint disease is pain in the knee.

The reflection of an irritation causing pain up one branch of a nerve and down another is of very common occurrence. The pain occasionally felt in the eye on eating ice cream is explained by the fact that the trifacial or fifth cranial nerve has three main divisions, the ophthalmic and superior and inferior maxillary; and irritation of the second or third, through a tooth, for instance, is reflected to the distribution of the first branch. In a similar manner a decayed tooth may be the exciting cause of earache; wax in the ear, of pain in the shoulder; and heart disease, of a numb pain down the inner side of the left forearm. The sensation of pain is even at times projected, as it were, out of the mind to some part of the body: as when one sees an injury about to occur to another person, a sharp twinge may be felt in the member or part of the observer that appears likely to suffer trauma in the observed individual.

The precise causal nature of pain varies, of course, with special conditions. Thus, headache is an irritation of the meninges, or membranes covering the brain, by exogenous or endogenous poisons circulating in the blood, by changes in the volume and force of the circulation, by the pressure on or entanglement of sensory nerve fibers by tumors, depressed bone, or cicatricial tissue following past inflammation, etc. Neuralgic pain has been defined as the "cry of a nerve for pure blood," and the substratum of much physical suffering is merely malnutrition. Even in pressure pain the interference with normal cell changes in the region mechanically involved cannot be excluded.

The degree and character of pain is modified obviously by the nature of the cause. Inflammatory pain is generally constant and severe, with loss of function and other signs of inflammation, and is increased by firm, deep pressure. Non-inflammatory pain, as a rule, is remittent or intermittent, and is relieved or not augmented by deep, steady pressure; in contractile pains, such as those of labor, a rhythmical recurrence is noted. Neuralgic pains are shifting and intermittent. Referred or reflex pains, due to lesions at other points having the same or related nerve supplies, are not affected by pressure, but are characterized by cutaneous tenderness in the same area as the pain. Hysterical pain is usually burning in quality and is subject to suggestion. At the onset of most acute infections the toxemia is manifested by general pain, soreness and malaise, often with an initial chill.

The type of pain is also characteristically altered according to the kind of tissues involved. There is constant aching in muscular pain. In bone affections pain is constant, deep, boring, and commonly worse at night. The excruciating pain which accompanies a "felon" is owing to the collection of pus under the close and rigid periosteum, the membrane covering the bones. In mucous inflammations, as of the sac covering the front of the eye, there is sorness or a burning feeling. In serious inflammations, pleurisy for instance, the pain is sharp and stabbing—"a stitch in the side." This latter symptom is commonly due to cramp of the intercostal muscles, caused by overuse, as in the rapid breathing of running. Local skin affections are marked by burning and itching sensations. Neuralgic and neuritic pains shoot along the affected nerves, with tingling and numbness. Paroxysmal, colicky pains are noted with gas collections and in any obstruction of a normal channel, for example the common bile duct.

Atmospheric changes affect not only rheumatic pains, but lithemic, neuralgic and neuritic as well. Pain is increased by movement in diseases of the bones and joints, muscles and nerves. Pain is diminished or absent in shock and in gangrene. The localization of pain is of as much importance as its character in the diagnosis of disease, but the careful physician ever bears in mind how many and diverse are the factors that may give rise to painful sensations in any certain region of the body, and he trusts chiefly to the physical signs and to laboratory findings to determine the prime source of the trouble. Thus pain about the heart is much more often due to flatulent dyspepsia than to cardiac disease, and pain in the "pit of the stomach" is not seldom the result of spinal or renal disease.

Pain is more of a blessing than a curse to the human race. It warns not only of danger from flame or frost, but tells of derangement of function in any and every part of the body. The decayed tooth, the cinder in the eye, the abscess, give notice that relief is required to prevent worse changes. Through pain the affected part or organ is enjoined to rest, which is nature's sovereign cure for many ills. The chronic maladies most to be dreaded are generally painless, hence insidious and often incurable. This kindly symptom pain should not be vituperated, but should be regarded as one of the foremost of those wonderful safeguards which Mother Nature has provided for the wellfare of her children.

Ingrowing Nail.

Tardif says that he has been able to cure all cases of ingrowing nail without recourse to the knife. He proceeds as follows: With a flat probe, or a match, he slips a bit of cotton between the edge of the nail and the inflamed flesh. Another strip of cotton is put along the outer margin of the ulcerated area, and the space between these two strips of cotton, and which is occupied by the ulcer, is thickly powdered with nitrate of lead. The whole is covered with cotton and the toe is bandaged. The dressings are repeated the following day, and every day until the incarcerated edge of the nail is plainly visible. Usually four or five dressings suffice. Then, with patience, the edge of the nail is lifted away from the flesh, and a bit of cotton is introduced under it to keep it up. As it grows it will gradually take its proper position above the flesh, this having in the meantime shrunk and shrivelled by reason of the applications of lead nitrate. The lead is to be discontinued as soon as it appears that the exuberance of the fleshy bed of the nail has been overcome. The difficulty seldom recurs. If this does happen it is necessary to repeat the treatment from the beginning. —Anjou Medicale.

Food for Nervous Individuals.

As a rule, salt meat is not adapted to the requirements of nervous people, as nutritious juices go into the brine to a great extent. Fish of all kinds is good for them. Raw eggs, contrary to the common opinion, are not as digestible as those that have been well cooked. Good bread, sweet butter, and lean meat are the best food for the nerves. People troubled with insomnia and nervous starting from sleep, and sensations of falling, can often be cured by limiting themselves to a diet of milk alone for a time. An adult should take a pint at a meal, and take four meals daily. People with weakened nerves require frequently a larger quantity of water than those whose nerves and brains are strong. It aids the digestion of food by making it soluble, and seems to have a direct tonic effect.

Headaches.

Dr. S. Weir Mitchell formulates the following conclusions: There are many headaches which are due directly to disorders of the refractive or accommodative apparatus of the eyes. In some instances the brain symptom is often the most prominent and sometimes the sole prominent symptom of the eye troubles, so that, while there may be no pain or sense of fatigue in the eye, the strain with which it is used may be interpreted solely by occipital or frontal headache. The long continuance of eye troubles may be the unsuspected source of insomnia, vertigo, nausea, and general failure of health. In many cases the eye trouble becomes suddenly mischievous, owing to some failure of the general health, or to increased sensitiveness of the brain from moral or mental causes.

Influence of Diet on Heart's Action.

J. L. Prevost and F. Battelli found that when animals were killed by asphyxia from occlusion of the trachea or by means of chloroform, the heart was arrested in diastole. If artificial respiration was produced, and massage applied to the heart, the rhythmical beating of the heart returned, providing the animal had been killed while digesting a mixed meal of meat and bread. In fasting animals, there were produced permanent fibrillary tremors. A diet of albuminoids only produced the tremors in some cases preceded by rhthymic beatings. Fat caused the tremors, hydrocarbons rhythmic contractions which were not constant. It may, therefore, be asserted that a mixed diet has the most favorable influence on the restoration of the cardiac function after asphyxia.—Med. Times.

Smallpox Germs.

It is now known that smallpox germs are communicated through the air as well as by contact. The smallpox hospital boats anchored in the Thames have produced a regular epidemic in Essex, yet the shore is nearly half a mile away and there has been no communication. In districts over which the wind has blown from the hospital boats 12 per cent. of the inhabitants have been attacked, while in the other direction the cases have been less than 1 per cent.

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OUR WILD FLOWERS.

It is well nigh time we turn our attention to the possible extermination of our flowers that grow in the woods and along the wayside. The eyes of the twentieth century are being opened to the beauty of nature; birds are being spared, but there has been little defense made for the wild flowers.

That some protection for the wild flowers that grow near the great cities is necessary, has long been the feeling of those who care for the blossoms that make a country walk or bicycle ride so attractive, whether the observer be a scientist or not. They seem to the casual observer, to grow in such abundance that extermination is almost impossible. To such a man the term "wild flowers" stand in a measure for the sturdy daisies and buttercups, and these seem well able to care for themselves. But there are many others which suffer from the visits of city people every spring, and are slowly but surely disappearing from the environs of towns or cities.

The wild flower is beautiful only when growing in its natural state; they hopelessly wither and fade a few hours after being plucked. Incidentally, grasping it carlessly, the root may come up with it, or even if the root is left in the ground, the poor little plant can scatter no seeds that year. Some nature-lover may see the destruction and burn with indignation, but from the point of view of the destroyer, he is merely a silly sentimentalist. The flowers picked should be such as will give satisfaction at home, should not be torn up by the roots, nor picked away entirely from the spot where they grow, and care should be taken that rare flowers are not picked at all.

The only remedy, then, for this thoughtless destruction of nature's fairest decorations, is education, and particularly, educating the young. Prof. F. H. Knowlton, of the United States Museum, at Washington, has made some excellent suggestions. He would form a society which would have for its purpose the education of townspeople in the proper appreciation of the wild flowers. An important part of this work could be done by the school teachers. It is to be desired that this cause will be taken up in earnest before some of the rarer species pass away, and it is our hope that the press throughout the country will lay stress upon this movement in order that our wild flowers may be put under protection without loss of time.

THE HEAVENS FOR JULY.

BY PROF. MALCOLM McNEILL.

The Constellations.—The head of Draco is nearly overhead somewhat toward the north, and the pole of the ecliptic is near it. Draco contains no very bright stars, but a great many moderately bright ones, reaching in a long sinuous line between the little and great dippers. The star Alpha Draconis is not now the brightest of the constellation, being less than third magnitude, while formerly it was reckoned as second. Its principal interest for us is, however, the fact that somewhat less than 5,000 years ago it was our pole star.

The slow change of the celestial pole about the pole of the ecliptic due to precession of the equinoxes has shifted the celestial pole to its present position near Alpha Ursæ Minoris. Alpha Draconis may be found on the line from the star in the end of the handle of the great dipper to the brightest star in the bowl of the little dipper somewhat nearer the latter. Our present pole star is not far from the same line extended. Ursa Major is in the northwest, with its principal stars at about the same altitude as the pole star. The principal stars in Ursa Minor, the little dipper, lie above and to the left, the pole star forming the end of the handle.

Cepheus is to the right of the pole star and Cassiopeia is low down, a little east of the north point of the horizon. Andromeda is in the northeast and Pegasus in the east, just rising. Cygnus is in the northeast with Lyra above, just east of the zenith. Aquila is in the southeast, about half way up. Capricorn is rising and Sagittarius is near the south meridian, low down. Scorpio is for the most part west of the meridian, but the long sweep of the tail reaches nearly to the south point of the horizon. Virgo is in the southwest, with Leo on the western horizon. Bootes is high up in the west and Corona is near the zenith.

Clear summer nights, when the moon is not above the horizon, give a fine opportunity for viewing the Milky Way. The part through Cygnus and toward Sagittarius can be well seen, and even an opera glass will show a multitude of small stars. The region in Sagittarius is especially rich and show up finely with the smallest telescope.

Phases of the Moon, Eastern time:

New Moon.	July	5.	7 h. 59 m. A.M.
First Quarter,	"	12,	7 h. 46 m. A.M.
Full Moon,	"	20,	11 h. 45 m. A.M.
Last Quarter,	"	27,	12 h. 14 m. A.M.

The earth is in Aphelion on the morning of July 4.

Mercury passed inferior conjunction, becoming a morning star on June 23, and reaches greatest west elongation on July 15. This is not nearly as favorable a time for seeing the planet as May; still, from July 10 until the end of the month, it rises more than an hour before the sun, and at the middle of the month the interval is nearly an hour and a half. It may be seen in the early morning twilight low down near the eastern horizon.

Venus is also a morning star, rising rather more than two hours before sunrise. The interval shortens a little toward the close of the month, but not much, although its distance from the sun diminishes about seven degrees. It is moving quite rapidly, 37°, through Taurus into Gemini.

Mars is also a morning star, and is beginning to rise early enough to be easily seen. The interval increases from an hour and a half before sunrise on July 1 to two hours and a half on July 31. Its brightness has not increased much as yet, but it is now about as bright as the pole star, and on account of its ruddy color not hard to identify. It moves about 22° eastward during the month from Taurus into Gemini. It is in the same neighborhood as Venus, considerably nearer the sun during the early part of the month; but the more rapid motion of Venus brings them nearer together, and at the close of the month Venus is only about 1° south of Mars.

Jupiter is moving around to a position suitable for evening observation. On July 1 it rises at about 9.40 P.M., and on July 31 at 7.30 P.M., and on account of its brightness it can be seen nearly as soon as it rises. It moves about 3° westward in the constellation Capricorn during the month.

Saturn rises earlier than Jupiter and is in still better position for observation. It comes to opposition with the sun on July 17, and is then abve the horizon the entire night. It is also moving westward in the constellation Capricorn, but at a slower rate than Jupiter, so the two planets approach each other slightly during the month. At the close of the month they are about 20° apart.

Uranus is in about the same position as during June, except that it moves about one degree westward during the month. It is in the southern extension of Ophiuchus, between Scorpio and Sagittarius.

Neptune is a morning star, rising a short time before sunrise.

Boulevard in Athens.

Mrs. Syngros, a wealthy Athenian, has furnished $59,000 to construct a boulevard in Athens

Correspondence

The Orion Plan of Cities.

Editor POPULAR SCIENCE NEWS:

It will be veritable paradise with rents and living expenses but half what they now are, with wages doubled, and the length of the working day greatly reduced. It is an important question how to build cities and towns so as to eliminate all the faulty and pernicious old features, and incorporate such new ones as will make a model suited to meet the wants and demands of this most advanced and most progressive age.

The plan here presented is the result of more than thirty years of study and observations, made while traveling in different foreign countries, aided by suggestions derived through history from the good and wise of every age and clime. Questions, criticisms and suggestions are invited from every quarter.

The special aims and objects are order, safety, comfort, cleanliness, perfect economy. There should be combined all the advantages of both city and country life without incorporating the disadvantages of either.

The prime requisites are as follows:

1. Separate the pedestrians from the teams and laborers by providing for the former promenades on the housetops, where they can enjoy the grandeur of the scenery which their elevation commands; while the latter share with the trolley lines the exclusive possession of the streets and the tunnels under the pavements, and where they can pursue their work without annoyance or interruptions from passing throngs of pedestrians.

2. Exclude the horses and other animals from the streets, and make the houses in the cities as clean and as well lighted and aired, and in every respect as agreeable and wholesome as the best model of a rural home ever can be.

3. Select suitable locations and secure enough land to lay out the plan of every city in all its completeness before the foundations are laid for a single building.

4. Confine all factories and industrial plants to a long and narrow belt, and all dwellings, business houses, etc., to another narrow belt parallel with the first; and keep these two belts always distinct and co-extensive with each other as the city develops and grows.

The characteristic features of the proposed plan are:

1. General plan of the city. The division of the territory comprising the city into the following distinct sections forming parallel belts; and the restricting of every kind of work, business or industry to the section assigned to it.

(a) The manufacturing and industrial plants next to and parallel with a railroad or a water course. (b) The residence section. (c) The great department stores, public buildings, theatres, museums, churches, etc. (d) Schoolhouses, lyceums, play grounds, parks, groves, etc. (e) Gardens and lots or little fields for the private use of the inhabitants of the city.

2. The streets. Trolley-car streets and boulevards regularly alternating with each other through the whole breadth of the city. Only single rows of houses between the streets and the boulevards. The streets and boulevards cut every half mile by crosstown streets. Crosstown foot-alleys every 200 feet.

3. An elevation building line. All buildings to be of the same height throughout every block; or the exceptions, when higher, pierced by the superior promenades and the automobile and bicycle tracks.

4 Covered promenades on the housetops, along the eaves of the roofs, for the exclusive use of all pedestrians.

5. Automobile and bicycle tracks on the roofs of the superior promenades.

6. Bridges to connect the promenades and the automobile and bicycle tracks across the streets.

7. The stores, shops, offices, libraries, reading rooms, etc., on the top floors; and arcades in front of these and immediately below the promenades.

8. Free elevators in every block.

9. Tunnelled railways under the pavements along the basements of the houses, for the purpose of bringing in merchandise, etc., and of taking away garbage and all other refuse, etc.

10. The sewers, water and gas mains, electric wires, etc., to be laid between the sub pavement tunnels and the streets, so that they can always be reached in the tunnels without tearing up roadbeds.

Some incidental features are:

1. Projected balconies connected with the superior promenades and arcades.

2. Observatories on the promenades.

3. The application of the decorative arts to everything upon the roofs; and to everything in view from the superior promenades.

4. Landscape gardening on the roofs of buildings.

To make a practical test of these proposed reforms, let there be erected one or several blocks of buildings, with the adoption of but two of the nine reform features here proposed, namely, the fourth and the seventh, that is building promenades on the house tops and placing stores, shops, etc., on the upper floors as well as on the lower. This would doubtless prove to be so great a success, not only financially, but also in every other respect, that the new model would at once become the study and admiration of the civilized world. Presently there would be inaugurated a revolution in the plans of building the newer sections of cities and towns all over the world, that would prove beneficial and become far-reaching in its revolutionary effects.

One third of labor's time and energy, which is absolutely lost under the existing awkward conditions, would be saved to the inhabitants of the cities built upon the new plan—a saving so immense, that the manufacturers in the older cities, working under the old conditions, could no longer compete with their products in the markets of the world, and all would be forced to adopt the new labor-saving plan of building cities and towns systematically in juxtaposition with the industrial plants.

ORION.

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The Buzzard Problem.

Editor POPULAR SCIENCE NEWS:

I was waiting for the answer to question 368 with interest, but the one given is so remarkably inadequate that I must have a try myself.

A buzzard on the ground in a stiff breeze may be considered as moving rapidly against the wind, and with a given velocity of wind there is a maximum distance which the bird could rise by the use of its own inertia. But the maximum distance, different for each wind velocity, it would be impossible for the bird to exceed without some other source of power. If a string connected the bird to the earth, so as to allow the continuance of the relative motion of bird and air, the only limit to the height the bird could rise would be the length and weight of the string and the depth of the atmosphere. Therefore, the problem is not any question of aeroplane principle, but how to keep that bird moving rapidly through the air.

Now for my guess, or working hypothesis, to speak scientifically. It is a guess because I have had no recent opportunity to observe any soaring bird.

As the bird moves through the air it is constantly changing the angle between the line of the wings and the horizontal. To take an extreme case, suppose the bird changes the direction of its flight ninety degrees. First it elevates the wing on the outside of the curve it is making, the inner wing of course going down proportionately as they remain in the same line with reference to each other. This changes the direction of flight and is equivalent to a down stroke with one wing At the end of the turn the bird resumes its original horizontal position, thus making a down stroke with the outer wing—one whole flap for each wing now, leaving the bird higher in the air at the end of the curve than at the beginning. The velocity could now be maintained by coasting down the height gained, a very little drop going a long way with such an efficient machine as a soaring bird.

In ordinary straight ahead flight the only motion necessary might be an imperceptible, or nearly so, lateral swaying of the bird's body, bringing more weight first on one wing, then on the other. Somewhat as one works up in a swing by leaning forward and backward.

In reading an account of the difficulties of balancing and steering an aeroplane, I remember the mention of the constant swaying motion of soaring vultures, from side to side, which the writer thought was to preserve the bird's balance in the eddies and changing currents. Is it not more likely that the bird was merely making the motions necessary to prevent its gradual descent?

So I wish Mr. E. K. would explain the source of the bird's momentum, or the momentum being given, how it is kept from constant diminishment, if only from the friction of the air. GEO. A. BATES.

Moonlight Rainbow.

Editor POPULAR SCIENCE NEWS:

Referring to the "Moonlight Rainbow" in your correspondence columns of May, 1902, recalls to my mind the only "lunar rainbow" I have been fortunate enough to see—and in one of the strangest location, namely, Chicago!

In the autumn of 1868 or 1869, going east on Randolph street, from the "Briggs House," early in the evening, I noticed this bow extending north and south in a perfect arch over Clark street, its center apparently at the intersection of Clark with Randolph street. This bow was white, with a slight tinge of color, as seen in the halo round the moon. It impressed me as did the one referred to by the correspondent of the Wheeler County News, as one of the most remarkable displays I had ever witnessed, and as I remember it, one of the most remarkable I ever expect to witness.

JOHN M. MILLAR.

Some Pleasant Acquaintances.

Editor POPULAR SCIENCE NEWS:

Any young readers who desire to make some very pleasant and enjoyable acquaintances this coming spring, can do so in the following manner:

Collect a good supply of bits of cotton batting, pieces of string and tow, hair from the tail or mane of a horse, and strips of cloth. Place them in some conspicuous place in the garden or orchard, and keep a sharp watch for the results. No sooner has the snow disappeared, and the first warm days of spring come, than, one after another, our feathered summer visitors begin to arrive from the south; or shall I say, our sweet voiced residents then return from their winter visits in the south?

The very first business of these new arrivals is to construct suitable summer homes for themselves, as soon as the weather warrants, and their sharp eyes are constantly on the lookout for suitable material out of which to build them. Rest assured that they will not fail to find the supply which you have so generously furnished them, and will well repay you before the season is over for the pains to which you have put yourself on their behalf.

Keep a close watch of your bird furnishing store daily, and you will not fail to find a constant source of interest in your customers. You will be surprised to find how early in the season the birds will begin to visit it, what a brisk business you will carry on with them, and what strange tastes and preferences they will display in their selections. The king bird and the golden robin, for example, will want all your cotton batting, and will endeavor in every way possible to get your entire supply. The chipping sparrows, on the other hand, will create a lively demand for your horse hair, while the robins will select the cloth and strings in preference to everything else.

Don't fail to provide a bird house also, made of a starch box with a hole cut in it for a door and the cover nailed firmly on Set it in some well-protected crotch of a knotted old apple tree, and Mr. and Mrs. House-wren will appropriate it for the summer, provided the blue birds or the tree swallows do not move in ahead of them.

They will not set much store by your tow and cotton supplies, however, but will fill the box nearly to the top with last year's grape vine stems, or similar material, and in one corner of the heap construct a tiny but cosy nest of withered stems of grass. All summer long, too, they will keep up such a singing and trilling as will delight you. Do not fail to make friends with the birds, in the spring, if you wish to render it one of the most enjoyable seasons that you have ever yet experienced. R. B. BUCKHAM.

Bird Protection and Cats.

Editor POPULAR SCIENCE NEWS:

The April issue of Bird Lore calls attention to what it calls the "cat question," and it is a question of no small importance. I have had plenty of chance to observe the stray cat, and know something about the damage these homeless felines do among the birds. There are a number of cats around my summer home that belong to no one, and some of them are almost as savage as the larger bog-cat of farther north. They live in the woods and by their claws; and during the nesting season live entirely on nestlings and young birds just out of the nest.

There was one large tabby in particular that killed from pure joy of killing, often killing bird after bird and leaving the torn bodies without eating a bite. It also killed many young rabbits before it at last got in front of a charge of No. 6 shot. There are many cats that go the same way, their owners do not take care of them and only feed them when they happen to think of it; the result is that the cats have to use their claws to get enough to eat and the birds suffer.

The bill in Massachusetts requiring cats to be licensed is a good movement, and should have hearty support. There are hundreds of these stray cats around every city; they are no good to anyone and chase away or kill many birds that would nest in our parks. Of course, they kill a great many rats and mice, but the rats and mice have not reached a stage where they can not be kept down by the home cats, traps, and dogs.

People keeping cats should think of this matter, and either kill all kittens or give them to some one who will take proper care of them. C. WILLIAM GROSS.

Questions and Answers

QUESTIONS NOT ANSWERED.

Answers are solicited, especially for all questions so far without replies. Questions will appear but twice, successively. The following question needs reply—366.

370. Size of Telescopes. What is the size of the largest telescopes ever constructed? P. P.

371. A Cat's Eye. What is the microscopic structure of a cat's eye, whereby it shines with a greenish light in the dark? P. P.

372. Typewriter Ribbon. Can any of your readers give me directions for making typewriter ribbon? AMARIAH.

375. Excessive Blooming. Can any one tell me what advantage it is to the Judas Tree to be clothed with flowers on every branch, from base to tip, as it is now in May, in the instance of a young specimen on my front lawn? What struggle for existence is helped by this excess of flowers? SUBURB.

376. Substitute for Quinine. Is there any substitute for quinine in treating malarial fever? That remedy does not agree with me L. F. G.

377. Swelling of Fingers. Why do the fingers swell in the summer time to a thickness greater than that in the winter? During the winter season my ring is frequently so loose as to be annoying, but just so soon as the warm weather begins, it becomes very tight, sometimes uncomfortably so. R. I.

378. Individuals Affecting Flowers. It is a curious fact that cut flowers wither and die sooner when worn by some people than by others. This has been noted by the writer. Florists are cognizant of this peculiar condition, and frequently have complaints made by their fair patrons that the flowers, though guaranteed fresh, "droop after being worn only one evening." Others having flowers taken from the same lot, may have kept them fresh for a week. Does the vitality of the person wearing the flower produce the effect? If so, how? If not, what is the cause? This is a strange thing, and may be noticed by anybody. P. S.

380. New Cement. Several months ago a statement was made in the Digest that Edison had perfected a new cement, equal to the Portland cement, but much cheaper, which would revolutionize building by enabling houses to be constructed of this "poured" cement. Is such a cement now manufactured, and if so, where?

M. S. W.

381. Cleaning Straw Hats. Straw hats rapidly become soiled and stained upon exposure to the weather, even those of the finest quality. What is a good method of cleaning a discolored straw hat? M. S.

382. Tarnished Silver. I have often noticed that soft boiled eggs blacken silverware. Can any one tell me why? Also I would like to know why unused silver tarnishes even when wrapped in cloth and kept in a dry place? C. R. H.

383. Pipe-Stem. Can any of your readers tell me how the hole is made in crooked pipe stems; sometimes the amber and the wood as well are both so bent that it is impossible to bore a hole through either with any ordinary tool. A J. L.

384. Mosquitoes and Germs. We hear a great deal nowadays about mosquitoes carrying malaria germs, but little is said as to how the germs originate. Is the mosquito in any way responsible for their origin? Possibly one of the M.D.'s among your readers can enlighten me upon this subject. J. M.

385. Transplanting Trees. What is the proper way to transplant young trees?

C. H.

ANSWERS.

321. Sound of Steam Pipes. The answer given in the March number to this question, while very plausible, is not correct in all instances, and refers more to the thumping sound in the radiators than to the hammering sound in the pipes themselves. Pipes for both steam and hot water heating are usually held in place by iron rings or bands, which are immovable. We know that when iron is heated it expands in all directions, and that the coefficient of linear expansion of iron (cast) is 0.0000105.

Let us consider first a hot water pipe whose length (a) at freezing point is 100 feet. Then its length at boiling point would be the product of a, b and c, where b is the change in temperature and c is the coefficient of linear expansion of iron. The final length of the pipe, therefore, at 100° C. is found to be 100.105 feet, or an increase of 1 and 0.26 inches over its length at 0° C. This increase in length of pipe must shove through the supporting rings, hence the hammering sound as the pipe slides through. In the hot water heating system, all of the water in the boiler and pipes must be raised evenly and slowly, and the circulation begins as soon as the water in the boiler begins to become warmer than that in the pipes. Hence, the lengthening of the pipes is very slow.

In the steam heating system, the pipes receive no heat until the water in the boiler has reached 100° C., and when this point is reached the steam is then forced rapidly through the pipes, and they in turn become rapidly heated and the lengthening takes place in a comparatively short period of time. The hammering is thus more marked in the steam pipes than in hot water pipes, owing to the difference in time required to heat them. When the pipes are again cooled another hammering sound occurs, owing to the shortening of the pipes as they cool.

A similar effect is often observed on the railroads where the sun heating the rails causes them to lengthen and causes the hammering by slipping past the spikes which hold them down or straining the plates where they are fastened together.

KAY SEE.

322. Do Fish Sleep? My observation confirms the opinion that they do. While living in New Hampshire, when I was a young man, there were seven ponds on one stream, all stocked with pickerel, perch, dace, bullheads, and eels. Every summer, on warm days, it was not uncommon to find large pickerel lying perfectly motionless just under the surface of the water; if a noise was made they would dart away; by being very careful a person could sometimes, with a quick movement, grasp them by the head and tail, and land them. When they were out of reach, I have slowly wound a line around them, bringing them ashore; at the first movement they seemed to awaken. Sometimes they would weigh three pounds.

J. R. SMITH.

338. Boric Acid in Food. The detection of boric acid in milk is not particularly difficult. The following is a simple method: Evaporate about an ounce of milk in a small tin pan after adding 3 to 5 grains of baking soda. Heat the residue very hot to burn off most of the combustible matters; then add muriatic or sulphuric acid till the residue is acid in reaction. Pour in the pan a little wood or grain alcohol—the first is the best, and set fire to it. A green flame is seen if borax or boric acid is present in the milk. The flame is seen best in a darkened room. It is much better to transfer the residue to a saucer or watch glass before adding the acid. J M. WHITFIELD.

340. Scientific Names of Species. The reason why Latin names are given to species, etc., is that scholars and scientists in all civilized countries read Latin and not always English, so there is a necessity for a language common to all scientific work.

For instance, in botany, many plants have different names in different localities, while the Latin name is the same everywhere. A plant called white hellebore in Connecticut, is poke-root in New Hampshire, and is false hellebore, swamp-hellebore, Indian-poke, Indian uncus, puppet-root, earth-gall, crow-poison, devil's-bite, duck-retter, itch-weed, bugbane, wolfsbane and bear-corn in other places, but if you say it is Veratrum viride, the botanist knows at once what it is.

There is, too, the pokeweed, called also poke, poke-root, garget, pigeon-berry, cocum, jalap, skoke, American nightshade, crow-berry, cancer-root, chougras, red-weed, red-ink plant, pecan-bush. Now who would know the proper name of the plant? But when you say Phytolacca decandra, you have it. You can see how closely the common names of the two plants resemble each other, and what endless confusion they would make if there was not a Latin name to go with them. The two plants are no relation and have no resemblance. MRS. W. W. W.

363. Hydrogen. Water is $\frac{1}{9}$ (by weight) hydrogen. Ammonia is $\frac{3}{17}$ hydrogen. Marsh gas, $\frac{1}{4}$; ethane, $\frac{1}{5}$; alcohol, $\frac{3}{23}$.

Hydrogen is very readily prepared by mixing together muriatic acid and scraps of iron or zinc. The escape of the gas is recognized by the bubbles passing up through the liquid. These bubbles may be ignited by a lighted match. The gas may be collected by putting the acid and zinc in a bottle from which leads a tube, one end through the cork, the other dipping below the surface of water in a pan or bucket. The bubbles passing through the tube may be collected by inverting over the end of the tube beneath the water, a bottle filled with water.

J. M. WHITFIELD.

367. Meerschaum Pipe. R. G. Paine asks the quickest and best method of coloring it. Like a great many things, the best way is much the longer operation. Use a button in the bowl, smoke slowly, taking care not to overheat it, allowing it to cool before refilling, and continue for several years. However, if this is too tedious for the questioner, or if he is not so strongly addicted to the fragrant weed, boiling in oil will do the business in short order. Any reputable dealer can have this done at moderate cost, but boiling in oil, and not wax, should be insisted upon.

The operation gives a deep, rich color that is permanent. NICK O'TEEN.

373. Cold in the Head. So-called 'colds' are acute infection of the nasal mucous membrane produced by the action of germs constantly present. If the normal vitality or resistance is impaired as by a lowering of temperature below normal, the germs gain a foothold and find a suitable soil for growth. In the process of growth they produce certain poisons or toxins which are absorbed into the system and produce the symptoms of headache and fever. The irritation of the toxins locally causes an inflammation of the mucous membrane, characterized by swelling and discharge of mucus and pus.

Accordingly, the indications for treatment of an acute infection of the mucous membrane are: (1) Cleansing with mild antiseptics with a small glass douche; (2) relief of headache and fever by appropriate internal remedies. Cleansing may be effected with a solution of Seiler's alkaline antiseptic tablets—one tablet dissolved in four ounces (half a tumbler full) of warm water. Use in a small glass douche—the Bermingham nasal douche is recommended. Cleanse the nose every hour or two. For the relief of the headache and fever, three grain doses of phenacetin every three hours until relieved. Don't use quinine.

Every person who is subject to colds should go to a competent nose and throat specialist and have a thorough examination. There will very likely be found a constitutional disturbance of some kind or a chronic affection of the nose and throat which can only be intelligently treated by a physician. The only thing the writer advises the sufferer from chronic nasal disease to do on his own responsibililty, is to keep the nose and throat cleansed daily with Seiler's solution. The nose and throat deserve even more attention in this way, as a matter of simple hygiene, than do the teeth. J. G. PARSONS, M.D.

381. Cleaning Straw Hats. Prepare two solutions as follows:

1. Sodium hyposulphite	2 drs.
Glycerine	1 dr.
Alcohol	2 drs.
Water	q. s. 3 ozs.

Mix.

2. Citric acid	½ dr.
Alcohol	2 drs.
Water	2½ ozs.

Mix.

First sponge the straw hat with solution No. 1, and lay aside in a moist room (cellar) for twenty-four hours; then apply solution No. 2 and treat similarly as before. Finally the hat should be gone over with a flat-iron, not too hot. If very dirty, the hat must be cleaned with some detergent and thoroughly dried before beginning the bleaching operation.

THOS. WILLETTS.

Electric Railway on Ice.

Certainly a novel electric railway installation was that made across the River Neva in St. Petersburg, Russia, last winter. It consisted in laying the tracks on the ice and operating the cars by means of an overhead-trolley system. There are but few bridges across the river at this point and an excellent service is given between the banks during the summer by ferry lines. During the winter, after the thick ice has formed, roads and footpaths are laid out, and the river presents a lively scene.

This last winter an innovation in the way of transportation was instituted by laying two electric railways across from bank to bank. One line operated between the Palace of the Senate, situated on the English quay and on the left bank of the Bolschaia Neva, and the Academy of Fine Arts at Wassili Ostrow, the rails being laid on a length of about 550 yards. A second line crossed the river, west of the Peter and Paul Fortress, where it is 1,100 yards wide. The railway routes were lighted by arc lamps, and formed a beautiful and animated scene every evening.—Elect. Rev.

CURRENT NOTES.

The Duration of Sleep.

One of the most important factors of good health, says The Neuropath, is a sufficient amount of regular sleep. During sleep, the brain and the nervous system recuperate themselves, and both will suffer accordingly if sleep is not sufficiently indulged in. It is certainly not so easy to lay down any general rules as to the exact duration of sleep. In grown-up people the need of sleep varies very much. It is influenced by the condition of the body. Several experienced physicians have, however, computed a table of average figures, and individual parties should try to train their personal needs for sleep accordingly. Of course, it should be well understood that the length of sleep should be computed according to the age of each individual.

Rheumatism Cures.

The New York Sun has compiled a list of no fewer than 1,437 different "cures" for rheumatism. There is no disease which seems to baffle the medical faculty more than this. It takes so many different forms and the knowledge of its causes is so indefinite, and on some points so much disputed, that though the majority of human beings are sufferers from it, sooner or later, and there are numerous remedies, experience does not show which way to turn for relief. What appears to help one case will aggravate another. The lemon cure might help some one whose system needed more acid, whereas the alkaline treatment might simply make the conditions worse.

Malleable Glass.

The art of making malleable glass, which is said to have been well understood by the Egyptians, but which has been for centuries lost, has been rediscovered by Louis Kauffeld, of Richmond, Ind., so the daily press says. Mr. Kauffeld is a lamp chimney maker, and has for years tried to devise a chimney that would withstand excessive heat. The new process, it is stated, renders possible the making of cooking vessels and various other utensils out of glass.

Hay Fever.

Two German investigators conclude positively that there is nothing in the popular belief that hay fever is produced by irritating pollen from plants. The disease is evidently produced by bacteria of some sort, but how it gets into the system is unknown.

Edison's Storage Battery.

The new Edison storage battery is now on the market commercially. It has been officially announced that the plant for its manufacture at Silver Lake, N. J., has been completed and that the company is ready to take orders.

BOOK NOTICES.

Animal Forms. By David S. Jordan, M.S., M.D., Ph.D., LL.D., and Harold Heath, Ph.D. D. Appleton & Co., 1902. Pp. 258. $1.10 net. This book deals with animal morphology, structure and life processes, from the lowest, simplest, one-celled creation to the highest and most complex. The illustrations, of which there are nearly one hundred and fifty, are beautifully executed and remarkably accurate, many of them from nature. Technical and scientific names have been avoided as far as possible, and a more interesting or valuable work of its kind cannot be found. Although numerous books of a similar nature have been put on the market during the past few years, there are none more attractive than this, and it deserves a place in every library. It is printed on plate paper, and bound in cloth.

Stray Leaves from a Border Garden. By Mary Pamela Milne-Horne. John Lane, London and New York. 1902. Pp. 340. A quaintly written and illustrated account of an old country house and garden in the form of a notebook, which to many people is most attractive. A restful, attractive work.

In My Vicarage Garden and Elsewhere. By Rev. Henry N. Ellacombe, M.A. John Lane, New York. 1902. Pp. 219. The writer of "In My Vicarage Garden" is too well-known to need much said of it. A selection of the chapter headings will best define the scope of the book: The Flowers of Early Spring—Flowers of Late Spring—Flowers of Summer—Flowers of Autumn—The Mixed Garden—A Backward Spring—Carpet Plants—The Rock Garden—Plant Names—The Scents of Flowers.

Diet in Relation to Age and Activity. By Sir Henry Thompson, Bart., F. R. C. S., M.B. Frederick Warne & Co., New York, 1902. Pp. 134. This little work should be of great interest to people who give thought in regard to what diet and care of the body means to one's personal comfort and health throughout life. Though there has been a great deal written on the subject especially during recent years, this work, covering as it does a greater part of the author's life and experience, will impress one as being of great value.

Animal Activities. By Nathaniel S. French, Ph.D. Longmans, Green & Co. 1902. Pp. 262. $1.20. With 205 text figures and illustrations. The aim of the author has been to interest and guide young people in the study of living animals. While a book applicable to school work, it is none the less useful for those who enjoy the study of animal life, without investigating the structure of the bodies. The subject is well covered from the Protozoa or one-celled animals, to the Chordata, or vertebrates.

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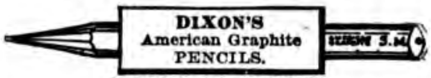

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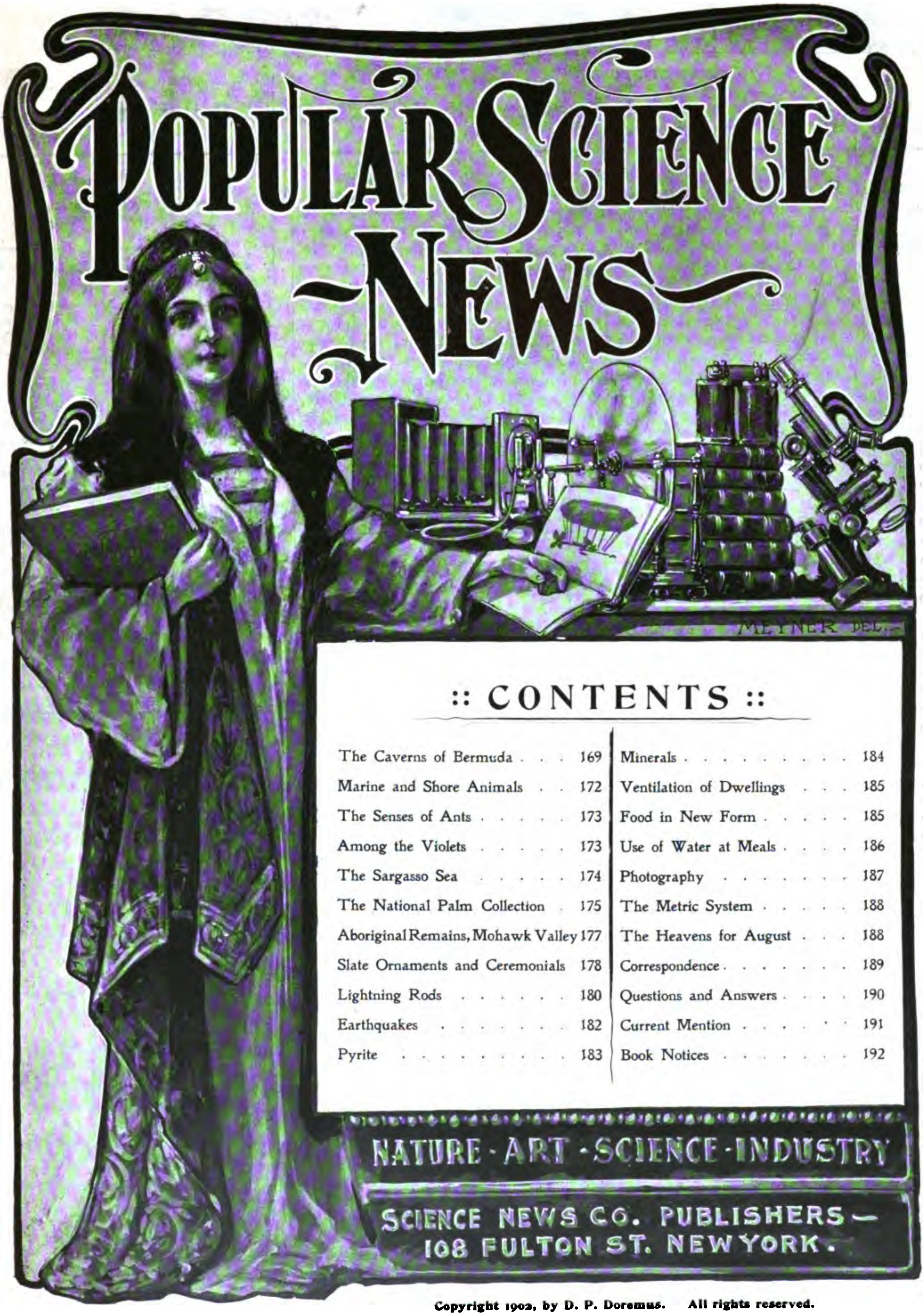

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Post Currency Bill.

It is said that Congress has been compelled to force upon the Treasury Department every reform of any moment instituted in the past twenty years, and it is quite time that Congress specifically instructed that Department to adjust itself to the public needs and to print its paper money of small denominations in such a manner that it may be conveniently and safely sent through the mails. It is a simple request of the people and, as the Postmaster General says in his report to the Senate and House committees, "It is not unreasonable to expect from the government that it will provide an easy, convenient and safe method to transmit small sums, say less than two dollars in amount, without putting the sender to the inconvenience and expense which now obtain in compelling him to purchase a draft or post office money order, and the bills in question aim to provide such a method"

The particular department official most opposed to the Post Check measure is Mr. Roberts, Treasurer of the United States, an honored official but grown old in the service. His objections seem to arise from an exaggerated idea of the work and change from the present routine, preferring to adhere to old methods no matter how imperatively new conditions may be demanded.

In other words, the preservation of existing official routine is placed at a higher value than the needs of the people arising from our rapid commercial development along new lines.

Opposed to that ultra conservative view are the opinions of Auditor Castle, and Third Assistant Postmaster General Madden, whose report meets every objection raised by the Treasurer. The last named gentlemen together with the Postmaster General, a business man of large experience coming to the Cabinet fresh from the people, refer to the Post Check currency as the best system known to them and it is noteworthy that their official experience has brought them into closer acquaintance with the needs of the people and the imperfections of the present system than any other members of the joint Post Office and Treasury committee established to consider this subject. The thanks of the country are due to these gentlemen for their willingness to consider the Post Check measure on the ground of its public utility and for their refusal to be hampered by existing official routine or to allow themselves to be entangled in the meshes of official red tape.

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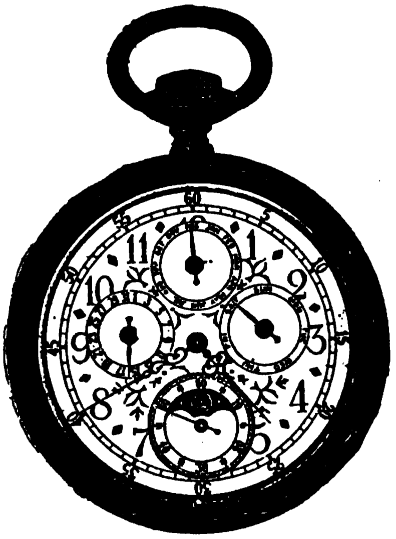

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Comets and Meteors.

A Fellow of the Royal Ast. Soc. says, in the Mechanic: I think it possible, and even likely, that there is some connection between (certain) comets and meteors, I cannot say that I know of anything like proof of it. So, again, with the so called meteoric hypothesis. It is quite true that no astronomer of any repute holds it; but it is blatantly put forth as established in a certain (very limited) number of papers and periodicals, and the uninstructed public think that what is so confidently stated must be true. Or take the period of rotation of the two inferior planets Mercury and Venus. One sees it stated, over and over again, how that they, like our own moon, respectively rotate on their axes in the same time that they take to describe their orbits. Inasmuch as the most absolutely contradictory results have been arrived at in this matter by observers of equal eminence and competence, we shall do wisely if we decline altogether to take any such coincidence as has been established.

Then, again, the connection of sun spots with the weather, which are alleged to run through a concurrent 11·11 year cycle. The general public see this allegation, and in their ignorance think that "there must be something in it." Perhaps they do not know that we are at present in the midst of a minimum period of sun spots, and that the last one occurred (13 years ago) in 1889. We haven't heard from the weather (or the magnetic needle) why they have so rudely contradicted the spot mongers and people who live on public ignorance and credulity at solar physical observatories and the like. Or once more, one sees it asserted as though it were an irrefragably established fact, that matter consists of vortex rings in the ether!—the said ether being, ex hypothesi, an absolutely homogeneous entity. Verily it has much to answer for in the shape of "wild-cat" hypotheses. But I might well fill a couple of columns with illustrations of such hypotheses which are gravely put forth as established facts, and accepted as such by hundreds who do not possess the means either of confirming or refuting them.

Theories of Origins.

In his address before the American Folk Lore Society, Dr. Frank Russell remarked: I have found that the presentation in the lecture room of the interjectional, gesture, and other theories of language usually leads to the liveliest discussion with the students, discussions that are sometimes adjourned to the home of the instructor. The ascertainable evidence relating to the origin of beliefs gives rise to widely differing inductions. A venerable friend who is preparing a treatise upon religion told me that he had found sixty-two theories accounting for its origin—and I had the pleasure of calling his attention to a sixty-third.

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The Martinique Eruption.

Prof. A. E. Verrill, of Yale University, writes to Science as follows: During many years of teaching geology I have held in opposition to most text-books on the subject that explosive gases are evolved during violent volcanic eruptions and that the flames seen by eye witnesses do actually exist, independent of lightning and the glow of the hot lava reflected from the jet of steam, etc., which are usually given as the explanation of the appearance of flames.

My view has been that the heat is sufficient to cause the dissociation of hydrogen and oxygen from the water, on coming suddenly into contact with highly heated lava; and in case of sea-water the chlorine would also be dissociated from the sodium. These gases suddenly ejected with great violence and exploding in the air, above the crater, would produce precisely the effects witnessed on an unusually large scale at Martinique.

The people were mostly killed by the sudden explosion of a vast volume of hydrogen and oxygen, which will account for the sudden burning of flesh and clothes, as well as of the buildings and vessels. The chlorine, at the same time, combining with some of the hydrogen would produce hydrochloric acid, a poisonous and suffocating gas, which would quickly kill most of those not instantly destroyed by the explosion.

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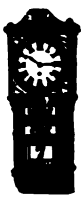
Ballooning Costly.

Count von Zeppelin, the German whose experiments with air navigation have brought him world-wide fame, is said to have been financially ruined by these same experiments. He is 67 years old and penniless, and he has sold his old airships for the mere material in them. The high cost of airship experiments may be judged from the fact that M. Deburaux the French aeronaut asks for $160,000 to build a balloon to cross the Sahara.

Air navigation, like early railroading and steam navigation, promises no profits for the capital invested, until it becomes more practical, and men of money are not eager to advance the large sums necessary to carry out crucial demonstrations.



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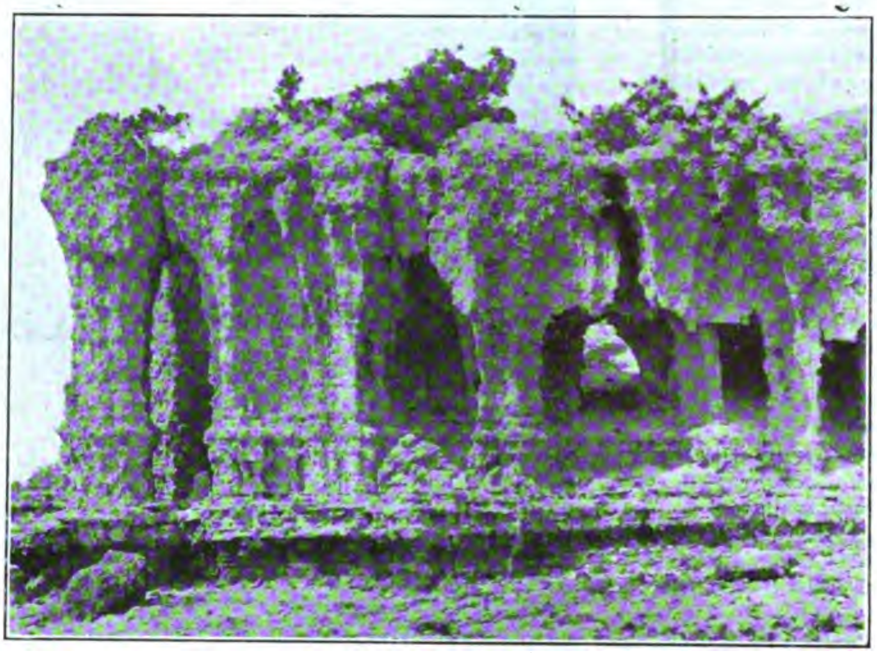


The Caverns of Bermuda

By A. HYATT VERRILL.

HUNDREDS of miles from any coast and surrounded on every hand by the restless surges of the great Atlantic, lies the little group of semi-tropical islands of Bermuda. Familiar as a winter resort, and intimately connected in the minds of most persons with early onions and potatoes, it will probably surprise many to learn that these little sea-girt islets contain more caverns to the square mile than almost any other portion of the world. Indeed it is no exaggeration to state that every cedar-clad hill encloses a cave.

This may seem strange to those accustomed to consider the Bermudas as "coral islands," but in reality they are not of coral formation at all, for from beating surf to wind-swept hilltops they are composed entirely of drifted shore sand. This sand consists almost entirely of broken sea-shells with a few fragments of coral. Although in many places the sand has become solidified to the hardness and fineness of marble, the process of formation can be readily traced step by step, from the loose shifting sand of the dunes and beaches to the hardest building stone.

In many localities the layers of stone and sand grade into one another in such a manner that it is difficult to say where one begins and the other ends. The sand, when packed tightly by the wind and remaining quiescent for any considerable length of time, becomes saturated with rain water containing carbon dioxide, and the separate particles become glued together—so to speak.

A peculiarity of this formation, which has a direct bearing on the caves, is that in the hardest and oldest rock and between layers formed centuries apart, are found strata or isolated accumulations of loose sand, which for some reason yet unknown, has remained unaffected by the percolating water.

Overlying the surface of the sand-formed rocks and especially in the valleys, is a layer of vegetable mould and insoluble residue of decomposed rock of a reddish-brown color,—the "red-earth" of the natives and the only fertile soil on the islands.

As there are no springs or streams in Bermuda, and as the caves invariably occur in hills instead of valleys, their formation has proved a puzzle to many, and it is evident they could not have been carved from the rock by underground streams, as is the case with Luray, Mammoth and other well-known American caverns. It is an established fact that the Bermudas in former geological periods covered an immensely larger area than at the present time, and in that remote age what are now hills were valleys.

Wherever in those ancient valleys a "sand-pocket" or sand-layer existed, the surface water,—and possibly long extinct brooks as well,—was absorbed. Finding the loose sand but a slight impediment to its progress, the water worked slowly through it to cracks connecting with the sea, gradually washing out the sand until a cavity of greater or less size was formed.

As Bermuda limestone hardens rapidly when exposed to the air, the walls of these former sand-pockets soon became harder than the surrounding rock, and as the erosion of the following centuries took place, were left as domed or rounded hills standing above the softer limestone.

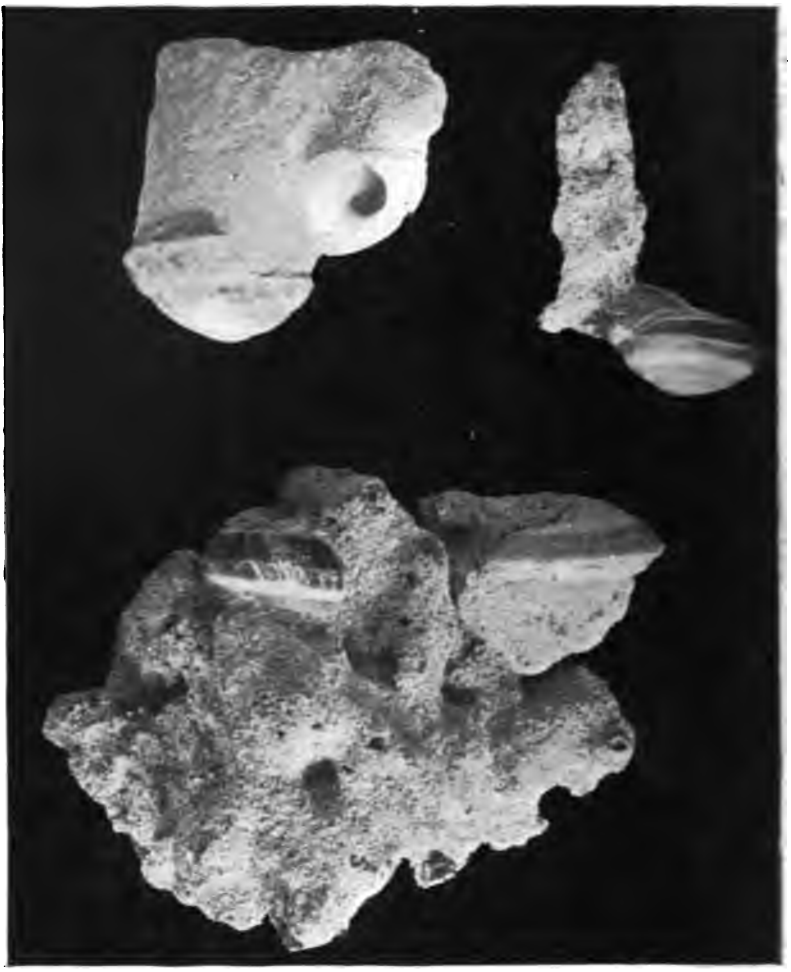
Then as the "red-earth" formed and trees took root and rain-water filtered through the cracks and crevices, the stalactitic or dripstone formation was deposited, still further protecting the interiors and walls from the wear and tear of time and the elements.

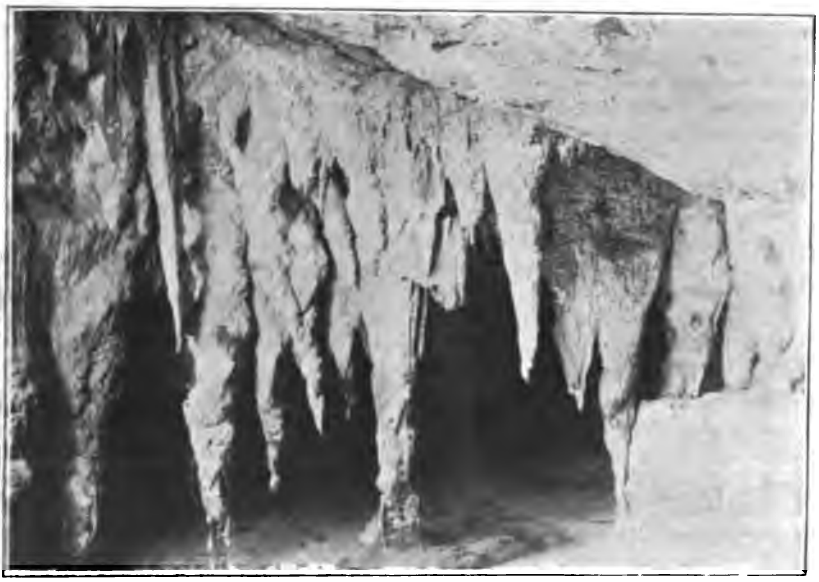
Unlike most other caverns, the Bermuda caves are all connected with the sea. In some, only a few inches of water covers the floor at high tide; in others the tide ebbs and flows several feet deep within their dark recesses; while in others the floor is completely submerged and the visitor is compelled to navigate them in a boat. Although the water is as clear and transparent as crystal, no fish are seen, notwithstanding there is easy ingress from the sea, but in all the so-called "grottoes," which are merely caves whose roofs have fallen in, fish fairly swarm.

The Walsingham Caves are perhaps the most frequently visited of any on the islands, although they are by no means the largest or most beautiful. There are probably a dozen caverns in the Walsingham group, situated near the shores of Castle Harbor on the eastern part of the island. The entrances to most of these, as in nearly all the Bermuda caves, are small and partly hidden by ferns, shrubs and drooping masses of convolvulus and jasmine.

The largest of these caves is about 200 feet long and perhaps 30 feet from ceiling to floor, but for fully half the height is filled with water, through which stalagmites rise upward to the surface. A narrow ledge permits the visitor to enter dry-shod to the innermost recesses however. The stalactites of the Walsingham caves are mainly large, often ten or twelve feet in length and three or four feet in diameter, and hang in pendant groups everywhere, a few joining the stalagmites below and forming columns. Unfortunately the stalactites and roofs of all the Walsingham caves have been blackened by the lack of care or interest of the owners in allowing visitors to light the interiors by flaming torches of palmetto.

The Penniston or Paynters'-Vale caves, although less than a mile from those of Walsingham, are almost unknown to tourists; they are carefully protected from vandalism, and retain all their original beauty. The entrance to Penniston's cave is a mere crack, barely large enough to permit one to enter on hands and knees. It rapidly opens out, however, and a dozen feet from the opening a person may easily stand erect. The descent is at first quite steep, and as the floor is strewn with large blocks and fragments of stalactites fallen from the roof, walking is difficult.


FOSSIL LAND SNAILS.


INTERIOR OF WALSINGHAM CAVE.

About fifty feet from the entrance the slope decreases and the roof,—which has hitherto been but eight or ten feet from the floor,—rises to twenty feet or more. In this portion of the cave are a number of curious formations of dripstone mixed with fine sand which gives the appearance of masses of stalactite covered with delicate frostwork. About 100 feet beyond this and fully eighty feet below the surface, the lowest level if reached. Here the floor is covered to a depth of several feet with water, which is half filled with fallen stalactites of all sizes, while from its placid surface and edges, great fluted columns of stalagmite rise upward to the ceiling.

Throughout the cave the stalactite formation is wonderfully beautiful and varied. The ceiling is everywhere covered with the glistening pendants, some slender as knitting needles, others huge, fluted, gnarled and rough; while scattered among them are thin, transparent sheets of crinkled dripstone, hanging like silken draperies from roof and ledges. Upon the floor and fallen stalactites new stalagmites have formed, and the red-earth, washed in by heavy rains, is covered with a thin and ice-like coating of the same material. Near the entrance, masses of roots, finding their way through cracks and crevices have become coated with the dripstone and the organic material decaying has left masses of hollow interlaced tubes. All is white; a glistening, frosted, creamy white, save here and there where the red earth shows dully through its glassy covering, or masses of fossil snail shells (a species of Helix now extinct and known only from Bermuda) rest preserved for all time by the same stalactitic coating, with their colors still bright. In this cave the visitor may watch the stalactites in the very process of formation. Many of the smaller ones are so transparent that by holding a candle behind them the internal tube, filled with water and even the crystals of lime held in solution, are plainly visible, while at the point a drop of water always glistens, ready to drop to the floor below and form a tiny deposit on the slowly growing stalagmite rising ever upwards.

ENTRANCE TO SUBMERGED CAVERN.

On Tucker's Island, in Hamilton Harbor, is a very large cave, well worthy of a visit. This cavern is about 300 feet long, from 50 to 200 feet wide, and is probably fully 60 feet from roof to floor, but as the latter is completely covered with several fathoms of water, its actual dimensions are difficult to determine. This cave is navigated by a boat, on which visitors embark at a landing-stage just within the narrow entrance. The stalactites are remarkable for their huge size, many of them eight or ten feet in diameter; and for the fact that the majority reach from the vaulted roof to the submerged floor, forming grotesque pillars, arches and colonades springing upward in a myriad forms from the surface of the stygian sea upon which the boat floats in profound silence. All the stalactites are dead, or in other words, have ceased growing, and are mostly covered with a fine, slimy, dark green algæ. This cave is lighted by acetylene gas from a generator outside the entrance, and is the only one so equipped on the islands. It is also one of the few caverns to which an admission fee is charged. The Bermudians,—who are generally all too ready to annex the nimble dollars of tourists,—have apparently remained insensible to the value of their caves as a means of revenue.

Rivalling the Tucker's Island cave in size, and in fact the largest known caverns on the islands, are two twin caves penetrating the high cliffs on the north shore near Bailey's Bay. These caves are partially submerged at high tide and the waves, dashing within in times of storms, have destroyed all but the largest stalactites and dripstone formations. At present they are mainly of interest because of their large size and the manner in which they serve to illustrate the transition from true caverns to the "natural arches" and "bridges."

As the surrounding rock is worn away by waves and weather, the stalactite-coated walls remain, and in the course of time stand out boldly from neighboring cliffs, presenting the appearance of the "Cathedral" or "Church-Rocks" in Somerset Parish on the western portion of the islands.

But even the resistance of the dripstone is gradually overcome by the elements; pillar after pillar is worn away and finally only a small section of an arch remains, forming a structure like the famous "Natural Arch" at Tucker's-town or the "Natural Bridge" on St. David's Island. When situated further inland the caverns are frequently destroyed by the roofs falling in. In the case of small caves so-called "grottoes" result, such as the "Devil's Hole" on Harrington Sound. If of large size, bays or lagoons may be formed, and many geologists affirm that Harrington Sound itself is merely an enormous, water-filled cave, whose roof, countless ages ago, collapsed.

Doubtless, many a large and beautiful cave still remains undiscovered in Bermuda, in fact that such is the case is clearly proven by the report of the naval engineers, who, when excavating for the great floating dry dock at Ireland Island, discovered immense hidden caverns of wondrous beauty, but which, unfortunately, it was necessary to entirely destroy, in order to make room for the handiwork of man.

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New Uses for Paper.

Paper teeth would appear to many people at first sight quite impracticable and useless, yet actual use has proved them to be in every respect equal to those made of porcelain or other similar compositions. Dentists in Germany are now making them as prominent in their work as the latter, and in every case they are said to give satisfaction. Naturally, too, they are very much less expensive than the false teeth used hitherto, while they cannot break so easily, and are not in the least susceptible to conditions of temperature.

Another queer and interesting use modern ingenuity has found for paper is to manufacture foot-gear from it. So skilfully can it be prepared for the purpose, that in appearance it is almost identical with that of patent leather. It is, however, considerably lighter, and so thin that it apparently reduces the wearer's feet a couple of sizes or more—a fact which will doubtless go a good way towards bringing paper shoes into popular use, for most people have an inward and secret desire to possess small feet. Such shoes are best suited for housewear, more especially through their fragility rendering them hardly durable enough for outdoor wear.

Animal Life

MARINE AND SHORE ANIMALS.

BY L. LAVINIA VERRILL.

During the summer when the days grow monotonous and uninteresting,—when the usual amusements have become tiresome, and even the latest magazines or books have been read and re-read; then, if you would create a new amusement, attire yourself in some rather second-rate clothes (if you own any) and go down on the shore at low tide. There you will find much to prove interesting, and at the end of the day you will have learned much from the inhabitants below high water mark, without having steeped your brains in a technical scientific study of them. If you walk lightly you may see a few hermit crabs out for an airing, or indulging in a claw to claw fight over a shell house. These amusing little creatures are deserving of more than a passing glance. If you should pull one out of his shell, you would discover a soft body with a hooked end by which the hermit holds fast to his house. His legs are crowded toward the front of his body and his bright eyes are always on the lookout for food.

Young hermits swim near the surface of the water like other crabs, but as they grow older they look about for substantial residences of shell. These shells are sometimes large and sometimes very small. The land hermit of Bermuda is quite large and it is said that this crab has been known to steal chickens.

Other shore animals found at low water, are the worms, which build tubes for themselves in the soft mud and sand. Under almost any rock these worms may be seen, their heads protruding from the mud. One of the most brilliantly colored of these worms is Nereis virens, which often grows to seven or eight inches in length. When examined under a microscope, its head seems very ferocious, provided as it is, with black, formidable jaws. Two other kinds of worms are the Planarians and Nemerteans, the former flat, dark-colored and not easily noticed, the latter long and smooth, commonly brown or red. There is one rare Nemertean, however, which is white and perfectly blind.

On almost all the rocks and particularly on ledges, piers and docks grow barnacles, large and small. Their life story is an interesting one. When in the embryo stage they are like other crustaceans, supplied with antennæ, legs and tail. For a month or two they swim around, and then, finding a convenient place, such as a rock or stone pier, they fasten themselves upside down to it, by means of a cement-like fluid which they excrete for this purpose. This fluid, which contains lime, hardens, and they are thus gradually inclosed by a wall of shell formed of six small plates, arranged in such a way that the animals can open two plates at the top and put out their arms. These arms look like soft feathers and are constantly in motion, circulating water through the barnacles and also collecting microscopic food. Strange as it may seem, these feathery arms were once the legs of the barnacles and they change their shape while the shell is in process of formation. Clinging tightly to the seaweeds and rocks along the shore, you will find many starfishes. The common variety of New England, reddish brown and orange in color, and from three to six inches across, is very beautiful, especially when it is seen clinging to the dark colored seaweeds in some sheltered tide pool, seeming almost like a star reflected in some dark sea. The starfish has a peculiar power of repairing injuries, for when an arm is broken off, a new one grows in its place, and moreover, an arm itself forms four new ones and thus becomes a whole starfish.

Starfishes feed on mollusks, and are, of course, troublesome to oyster growers. When a starfish eats an oyster the process is certainly an odd one, for it folds itself around the shell, turns its stomach out of its mouth, and pushing it in between the shells of the bivalve victim, digests the oyster without taking it inside its own body. Many people have made the mistake of supposing the orange spot on the back of the starfish to be an eye. In reality it is porous and through it is filtered the water to supply the water tubes which move the suckers on the under side of the arms of the starfish, and these suckers are used as feet. But the real eyes are found at the tip of each arm.

A near relative of starfishes is the sea-egg, sometimes called the "sea-urchin." These spiny balls live on rocky shores and occasionally small ones may be found under stones at low tide, but the full grown ones live below low water mark, in cracks and crevices of the rocks or among stones. Collectors of curios often find the thin, empty, spineless shells of sea-eggs washed up on the beach and would hardly recognize them in their living state. The shell which covers the soft body is formed of many plates, while fastened to these plates are spines, each one resting on a little knob, and the spine is moved by muscles surrounding its base. The common sea-egg is from two to four inches across and quite thick. It has the appearance of a ball of spines. The usual food of this animal consists of sea-plants, which it gnaws quite fine with its sharp teeth.

Almost everyone who has ever kept a salt water aquarium is quite well acquainted with the sea-anemones; those soft, jelly-like spots on rocks and shells, so uninteresting when contracted and when expanded resembling some beautiful starry flowers. Sea-anemones feed on small animals which catch in their extended tentacles and are then drawn into the mouth. Although they usually remain in one place, these soft bodied animals can move slowly about by their muscular bases. In aquariums they are very interesting, but unfortunately they have voracious appetites, a fact which often proves fatal to the existence of smaller animals in the aquarium.

On dark nights the water is often lighted by phosphorescence, and in rowing, the water that drips from the oars seems like liquid fire, while around the wharves and rocks, the breaking ripples are bright and shining with this strange light. The innocent causes of this, are swimming lazily along near the surface of the water, for this light is due to the presence of jelly-fishes, beautiful, circular, transparent animals when floating and a lump of sticky jelly when caught in one's hand. These curious animals swim by contracting and expanding their bodies, but they never seem able to move with much force or in a definite direction, rather drifting whereever the currents take them. Almost any day they can be found in tide-pools along the shore but being transparent they are often over-looked by collectors. They vary greatly in size and often reach a diameter of a foot by the end of the season.

Mr. Emerton, in his "Life on the Seashore," describes their growth in such an admirable way that I cannot do better than to quote from him: "In the jelly-fish are four colored masses half-way between the mouth and the rim, which consists of eggs. Late in the summer, if the animal is put in a pan of water, some of these become loose and slowly creep about on the bottom. These eggs, or larvæ, as they may now be called, are dropped loose in the water, and those which happen to find suitable resting places become attached by one end and soon open a mouth at the other, surrounded by tentacles something like a minute sea-anemone. They live in this way all winter. In the spring these polyps elongate and divide transversely into a pile of jelly-fishes, which drop off one by one and swim away. At this stage they do not look much like the adult, but have eight long arms, forked at the ends and between these as many rounded lobes. As they grow larger, the lobes increase more rapidly than the arms, so that the outline of the animal soon becomes a circle slightly scolloped. The forked arms carry between the prongs the eyes of the jelly-fish, and these remain in the adult. As the lobes grow, they develop along the outer edge a fringe of five tentacles; and at the same time four large tentacles grow around the mouth, and the ovaries begin as four clusters of tubes. The radiating branched lines running from centre to circumference are tubes which branch from the central stomach, run to a circular tube around the outer end of the animal, and are the only circulating vessels that it has."

One of the most pleasing amusements of the summer is collecting specimens for an aquarium, and many hours can be profitably spent watching the habits of the interesting shore animals.

The Senses of Ants.

How do ants, whose blindness has been demonstrated time and time again by science, find their way about in dark or light as though they had the sharpest eyes in the world? How do they recognize relatives whom they have never before met, and how do they find their way back home when they have wandered many yards away?

These matters which no scientist could explain, have recently been expounded by Miss Adele M. Fielde, of New York City, who has for a number of years been noted as an authority upon ant life.

The ant has always been known to work independently of daylight. To this wonderful insect night and day are alike. It has no regular period for sleeping, and even in the sunlight it can only see one-quarter of an inch in front of its eyes. Yet, to the bewilderment of all naturalists who have studied its ways, the ant builds its nests, constructs long tunnels underground, forages for food a long distance from its nest, knows its own relatives from all other ants, and finds its way back to its own home over roots, stones, and leaves, even though it may travelled 100 yards or more. It can do all this in spite of the fact that it is practically blind.

The explanation of this mystery, says Miss Fielde, lies in the extraordinary fact that the ant finds its way about not by sight but by smell, and has five separate little noses in the ends of his antennæ. Every ant has two long flexible antennæ, or projecting horns, located on the front of its head. These antennæ have each twelve sections or joints, and Miss Fielde has demonstrated before the New York Academy of Sciences that the last five joints have the sense of smell.

By the twelfth joint, or extreme tip of the antennæ, the ant can tell its own nest from all other nests. It seems that every nest, every family of ants, and every individual ant have a smell by which they can be recognized. By the eleventh joint, or nose, the ant recognizes its own blood relatives, even if it has never met them before. By the tenth joint the ant can scent its own trail, in the same manner that a hound can follow the path that has been taken by a fox or a rabbit. By the eighth or ninth joints the ant recognizes the children that belong to its own nest in distinction from the children of other nests.

It is possible that the remaining seven joints have also peculiar powers of smell, but, if so, they have not yet been discovered. Cut off the tips of its antennæ and an ant will not know its own home. It is just as likely as not to wander into the camp of an enemy and be torn limb from limb. Cut off the eleventh joint and the ant will not know its own mother, father, uncles and aunts, brothers, sisters, and cousins. Cut off the tenth joint, and the unfortunate ant will be hopelessly lost, even if it be no more than six inches away from its own home and family. Like a Dakota farmer in a blizzard, it will wander here and there, north, south, east, and west, in complete bewilderment. Cut off the eighth and ninth joints, and the ant will not recognize the children of its own nest, which it may have been washing and feeding a few hours before.

With all five joints cut off the ants become entirely indifferent to one another. They cease to co-operate and stand stupidly about, as if they had been benumbed by a blow. The ants which Miss Fielde keeps as domestic pets are the ordinary medium-sized brown ants. Their scientific name is Stenamma fulvum piceum, and they are found wherever there is mellow soil and loose stones.

The Leg as an Organ of Hearing.

Writing upon the interesting subject of "Fore-legs and Their Uses," Mr. E. A. Butler observes in Knowledge, that "the common lobster furnishes one of the best possible illustrations of a curious principle that finds expression in the organization of animals whose body, like its own, is composed of a succession of segments with jointed appendages, or in other words, animals belonging to the great sub-kingdom Arthropoda. The principle in question is that the paired appendages of the different segments, though all constructed upon the same plan, may become so modified in form as to be adapted to the discharge of the most diverse functions.

One of the strangest and most unexpected of the uses to which we could imagine a leg as being put is that of an organ of hearing. Yet such seems to be one at least of the functions of the fore-legs in the cricket and some other allied insects. On the outer side of the tibia a small oval space may be seen in which the strong armature which covers the rest of the body is reduced to a thin and membranous condition, making thus a sort of window or drumhead. Communicating with this, inside the leg, are the ends of a nerve, and it can hardly be doubted therefore that the whole apparatus constitutes an auditory organ, so that if these legs were amputated, the insect would become deaf.

When one remembers that crickets are amongst the noisest of insects, their incessant chirrup being a most shrill and penetrating sound, it cannot be considered strange that distinct organs of hearing should also be present; the sound-producer implies the sound-perceiver; the two functions are complementary; but it is remarkable that the fore-leg should have been selected as the most suitable site for this important sense."

Palmieri's Apparatus.

The apparatus in Palmieri's observatory on Vesuvius indicates every impending eruption long enough in advance to give every one timely warning.

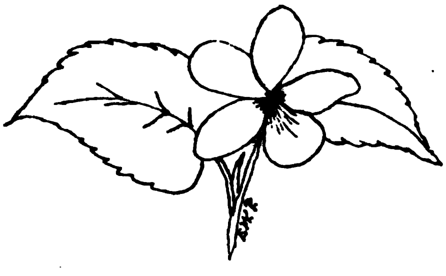
Plant Life

AMONG THE VIOLETS.

BY BESSIE L. PUTNAM

"Out from the sunned and sheltered nooks
The blue eye of the violet looks."
—Whittier.

Few of our native plants are entitled to or receive more affectionate recognition than the violet. While most cosmopolitan, being found from Hudson Bay to Florida, and from the Atlantic to the Alaskan shores, it is equally at home in the eastern hemisphere. It has the simplicity and grace of the strictly American plants. The Yellow Violet, so poetically, if not scientifically, described by Bryant in 1814, is said to have been the first poem devoted to an American flower; and though later writers have failed to find the imputed fragrance in the species designated, and the author has been criticised for placing the period of bloom with that of retreating snow, the sylvan picture is one that we are glad to retain in our literature.



THE VIOLET.

Modest and unassuming at all times, it has characteristics so pronounced that even a child will have no hesitancy in determining its identity; and a violet is a violet, be it white, yellow or blue, and found in woodland or meadow. Britton and Brown describe about thirty species as indigenous east of the Rockies, while nearly as many more are found in the extreme west and south.

There are five petals, the lower one larger than the others and usually more or less spurred. The five stamens are closely banded together, and the two lower have glands at the base for secreting nectar; these communicate directly with the spur reservoir.

The plan to secure cross fertilization is quite ingenious, though by no means so elaborate as in the orchids. The style terminates in a club-shaped stigma slightly beaked. This is surrounded by the cohering anthers. The lateral petals are densely bearded, and the visiting insect, finding no convenient footing at this point, follows the honey guides marking the lower petal into the groove leading to the store of sweets. By experimenting with a pin we shall find that some of the pollen is brushed upon the bee in its retreat. This does not touch the stigma of the flower from which it was obtained, as the latter is protected by the projection; but the stigma of the next flower visited is brushed against, and some of the dusty load involuntarily deposited. Thus is pollen borne from one flower to another, thereby maintaining the vigor of the species.

Despite this nice little plan for cross-pollination, the gay blossoms of spring frequently bear little seed, and the great work of perpetuating the species is through small, inconspicuous blossoms without petals, produced freely during the summer months. This is notably the method of V. cucullata, the common blue violet of the meadow. These blossoms do not open and have the semblance of small buds. The stamens are usually incomplete, yet from them pollen grains are sent out to the numerous ovules, and the seed produced by these cleistogamic flowers is plentiful and vigorous. Gray attributes the use of these cleistogamous flowers (which are not confined to the violet family), to economy in nature. And when we consider that while some violets contain only one hundred grains of pollen, in some insect-fertilized flowers the number runs up into the thousands or even millions, the vast saving is apparent. Since no species, so far as known, is exclusively cleistogamous, the theory suggested is plausible, thus multiplying at the smallest expense and at the same time renewing vigor by occasional cross-pollination.

The seed pods open by a contraction of the edges of the carpels, throwing the seeds some distance.

There are two distinct groups of violets, those with leafy stems and those having flowers on leafless scapes. The foliage is rounded, cordate, halberd-shaped, or narrowly divided in the various species.

The earliest is the dainty little V. blanda, with small white, slightly fragrant blossoms. Later comes the distinctly odorous Canada violet, much larger, and its petals often tinged with violet on the outside. Closely resembling it and contemporaneous is V. striata, but with stipules incised instead of entire. The halberd-leaved violet was formerly regarded as rare, though there are now many places in which it is locally plentiful. It is one of the earliest, and has pale yellow flowers. The leaves are distinctly-halberd shaped, and so far as the writer's observations go, they are beautifully variegated, the lighter portion having a silvery sheen worthy of some fancy begonia. I have never seen this peculiarity mentioned in any manual, yet if constant it should serve as a distinguishing feature. It is more pronounced in midsummer than early in the season, though noticeable at all times.

The garden pansy is a variety of V. tricolor, the well-known Johnny Jumpup, and admirably illustrates the possibilities of florists' manipulations. Though so greatly improved in size and form, the general structure remains unchanged, and the details of cross fertilization may be here observed more distinctly since they occur on a larger scale.

Most of the violets respond readily to cultivation, and are well worthy of the care bestowed. The subterranean rootstock is of interest, its toothed surface being but traces of undeveloped leaves, as proved by the shoots starting from their axils.

The history of the violet is an ancient one, merging into mythology. Poets sang of it, and medicinal uses or dyes rendered it of commercial value to the more prosaic world. Its odor is caught in a standard perfume, and the fragrance of the blossom which became the watchword of Napoleon's followers, is now literally wafted around the world.

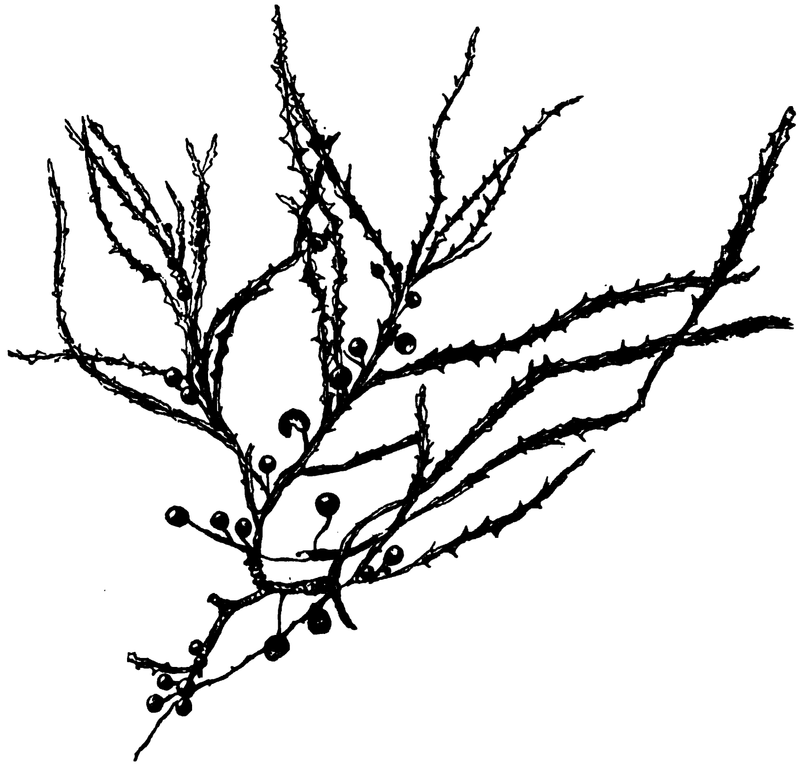
THE SARGASSO SEA.

BY CORA E. PEASE.

Probably no portion of the globe's surface has afforded a richer field for the imaginative writer than the Sargasso Sea, that portion of the Atlantic Ocean lying between sixteen and thirty-eight degrees north latitude and thirty and fifty degrees west longitude.

During our recent war with Spain some of our newspaper reporters, sending their imaginations soaring wildly over the Sargasso Sea, met stranger visions than did Milton in Paradise or Dante in the depths of Inferno. A Boston daily contained an article anticipating the naval battle that occurred at Santiago. The author, giving free rein to his fancy, thus writes:

"The battle will be fought on the northern edge of that strange and mysterious part of the Atlantic called the Sargasso Sea. It is not generally known that within a week's sail from New York is a vast and trackless waste, unexplored by the hardiest sailors, uncrossed by the statliest ships, a monster mass of floating debris, consisting of growing seaweed, blooming and blossoming plants, creeping and twining vines, a floating island of verdure almost as large as the state of Texas, forming a solid barrier against navigation. . . . The Spanish commander will very likely use this mass of floating sod to protect his flanks and rear from attack." It is incredible that a paper would print such ludicrous trash that the merest school child would at once recognize as utterly false.



SARGASSUM BACCIFERUM.

Another Boston daily copies from the Buffalo Commercial this most absurd account of a bark in passage from Rosario to Philadelphia during which it had "a strange experience in the well known but seldom visited and much dreaded Sargasso Sea. . . . Nineteen days were spent in a desperate battle with the floating seaweed and profuse flora. . . . We were actually driven back by its force. Some of the creepers were at least one hundred feet long, and they seized upon the bowsprit, spars, davits and everything into which they could entangle themselves." The article goes on describing the appearance of the bark bedecked with "streamers of moss and green stuff," which prevented the rigging from running through the blocks, so that the crew could not sail the vessel. Story writers often place their characters aboard some derelict forever doomed to float aimlessly "in this great swirl of the Atlantic," and in the course of their adventures these characters state as scientific facts the most utter fallacies.

Any child who ever saw the ocean would naturally reason that it bears on no part of its surface "blooming and blossoming plants." The Sargasso Sea differs in no wise from any other part of the Atlantic, excepting that it is so surrounded by currents that the alga known as Sargassum bacciferum floats here in somewhat greater quantities than elsewhere. It is also a section of the ocean lying without the range of constant trade winds, so that sailing vessels are sometimes liable to become becalmed, and one can well realize that a carpet of seaweed upon the surface of the water, when there is no wind to fill the sails, will tend to somewhat impede a ship's progress. But "a solid barrier against navigation" the slender seaweed is not, for, notwithstanding the authorities quoted, through the Sargasso Sea lies the southern passage from Europe to America for sailing vessels in winter. An intimate acquaintance, a worthy old sea captain, says that in his numerous voyages across this "unexplored, trackless waste," he never could have experienced the difficulties described unless he had sailed his vessel bottom upwards.

In my trips to the West Indies I have had the pleasure of seeing the alga giving the name to the sea, the Sargassum bacciferum, also known as gulf weed, sea grapes, grape weed, tropical grapes, etc., floating in long narrow streams, or stretched out on the surface of the water like beautiful golden brown carpets. By means of long boat hooks the sailors pulled some aboard for us to examine. There seemed to be three forms differing only in slightly varying widths and lengths of the leaf-like divisions of the fronds. Lady Brassey writes of finding five species, but Mr. Collins in the Phycotheca Boreali Americana classifies the specimens he has procured for study in two groups.

There seems to be some doubt among algologists whether the Sargassum bacciferum "grows forever floating" as expressed by Canon Kingsley in "At Last," or sometimes is found attached and fruited in the West Indies. "Fruiting specimens are among the greatest of algological rarities," according to Dr. Farlow of Harvard University. He has only one fruited specimen. This was collected on the coast of Florida. The most eminent authorities in the world doubted the existence of this specimen, but by actually seeing it they have had to acknowledge it to be a genuine fruited Sargassum bacciferum. As found floating it is always infertile, so must increase by branching and subdividing. Columbus in discovering America also discovered the Sargassum bacciferum, as he is the first person to have mentioned this seaweed.

The Sargassum vulgare, much resembling the bacciferum, is found on the southern coast of Cape Cod and elsewhere towards the south, and it might prove of interests to visitors to the seashore to search for the alga among the rocks at low tide, and see for themselves upon what a slight basis is built the silly stories of "flowering plants" and "twining vines" in mid ocean.

◆

THE NATIONAL PALM COLLECTION.

BY WALDON FAWCETT.

The United States government has recently secured for the National Botanical Gardens, at Washington, a specimen of a palm which is accounted the rarest thing in the vegetable kingdom. This marvelous product of nature, which is known as the double cocoanut palm, grows only in the Seychellarum Islands in the Indian Ocean, and some years ago one of the wealthy rajahs of India offered a ship's cargo for a single specimen of the rarity. For a long time it was supposed that this variety of palm grew in the sea. The seed requires seven years to ripen, and even the treasure seekers of the botanical world who visited the Seychellarum Islands and secured the seeds, from one of which the young tree in Washington has grown, were obliged to pay $10 each for the seeds. The only other specimen of the double cocoanut palm on this continent is at the Phipps Conservatory, at Pittsburg. The superintendent of the Botanical Gardens is having some difficulty with this latest addition to the great collection, inasmuch as it requires excessive heat. The new palm tree is now a little over two feet high, but will ultimately grow to a height of over 100 feet.

The collection of palms in the National Botanical Garden is constantly growing in size, and is fast reaching the point where it will compare favorably with the collections in the famous gardens in Berlin and Paris. There are in the institution in Washington more than five thousand varieties of plants, shrubs and trees, and this includes more than 125 varieties of palms. A huge date palm, over eighty years of age, and which ranks as the largest palm of any kind under cultivation in any public or private conservatory in the world, is the particular pride of the collection at the national capital.

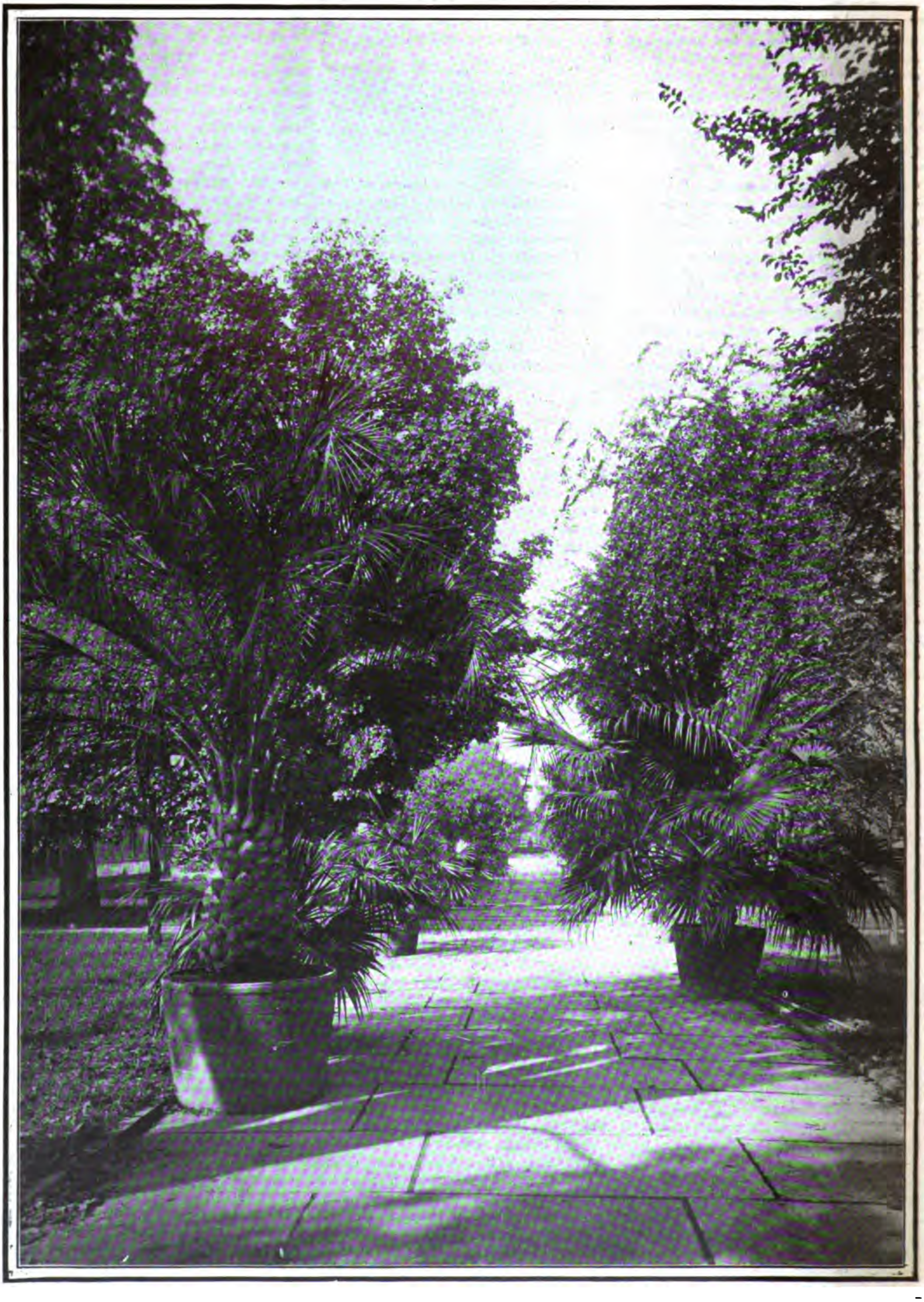
This giant palm has proven one of the most troublesome objects in the possession of the government. No less than thirteen times it has poked its stately head through the great glass dome which surmounts the main conservatory at the gardens, and now Congress is to be asked to appropriate money for an addition of twenty feet to the height of the dome, in order to give this king of the jungle growing room for some time to come. Some years ago the officials of the Garden thought that they had hit upon a way out of the difficulty, for the time being. A hole about a dozen feet deep was dug beside it and the palm, which has a trunk sixteen inches in diameter and spreads its leaves twenty feet, was slipped into it. However, in its new location the veteran took a fresh start and in a short time was again knocking upon the roof.

Thereafter the plan was adopted of each year sawing away the top of the tree, but each spring, when the sap begins to run, it shoots up again, and usually goes through the glass before the gardeners realize what is happening. Indeed, the tree presses against the glass so gradually that instead of breaking its boughs, it very frequently curves the panes around an arc several inches deep. Then, when the limit of the elasticity of the glass has been reached, the palm bursts through and rapidly throws out its green leaves into the open air. The wild date palms, of which tribe the one in the Botanic Garden is so magnificent a specimen, come from the mountains of India, and can be raised from seed. They attain an age of one thousand years, and the one at Washington has been in the possession of the government for nearly half a century. When it was exhibited at the Philadelphia Centennial in 1876, Prof Miller, the well-known landscape gardener, offered $1,000 for it, and it is now claimed to be worth several times that sum.

In the Botanic Garden is a very fine collection of the famous fan palms. When superintendent William R. Smith, the veteran director of the national palm collection, assumed his present post nearly half a century ago, there were only eight of these fan palms of the United States. To-day there are over three million. From the single specimen which originally had a place in the Garden, more than six thousand palms have been procured by means of sprouts. One of the interesting inhabitants of the Garden is a rare date palm that was sent some years ago to the National Museum, and was there so seriously injured by chemicals, that it was supposed it would die. However, the tree was taken back to the Botanic Gardens and carefully nurtured by the expert palm growers, with the result that it has now entirely regained its beauty.

In connection with the palm collection at the Botanic institution, is a monster assemblage of rare ferns, to which exceptional attention is now being devoted. There are more than four hundred varieties of ferns, including the surpassingly rare Elk Horn, Stag Horn and Moose Horn ferns, of Australia, so named because their leaves bear a most striking resemblance to the objects named.

The removal of large palms even for short distances without impairing the vitality of the plants, is one of the most difficult accomplishments of the horticultural world, and there has recently developed a most spirited rivalry in this field of activity between the officials of the Botanic Gardens on the one hand, and the palm experts of the Department of Agriculture on the other. At the suggestion of members of Congress it was determined, some time ago, to establish governmental palm gardens in the spacious courts of the General Post Office and the Pension Building at Washington, and for some little



A Walk in the National Botanical Gardens. Washington, D. C.

time past the work of transferring the giants of the vegetable kingdom to their new homes has been in progress. Thus far the workers at the Botanic institution appear to be in the lead, as a less proportion of their palms have died after removal than in the case of those brought from the Department of Agriculture.

Some idea of the work involved in moving these palms, which must of course be handled with infinite care, is conveyed by the fact that a number of the palms weigh in the neighborhood of a ton each, while some considerably exceed that weight. Among the palms that have been given places in the Post Office building are two rare fig plants of ripe age, one of which came from Calibar and the other from South America. It is claimed that the presence of these palms in a large building where hundreds of men and women are employed, will have a beneficial effect on the health of the clerks.

Experiments are constantly in progress at the Botanical Gardens with a view to discovering new spheres of usefulness for palms, principally, of course, in commercial pursuits, and Superintendent Smith has lately discovered heretofore unknown properties in a species of palm, the extensive cultivation of which, in the tropics, he will soon advocate. Experiments are also being made with banana trees and with coffee plants, which latter have always presented a perplexing problem to the cultivator, owing to the difficulty of providing the requisite amount of shade.

New Species Suddenly Formed.

A highly interesting address by Hugo de Vries of the University of Amsterdam, Holland, gives a detailed account (Science, May 9), of a number of variations of the Evening Primrose equivalent to new species, and properly regarded as such because they were not mere chance variations of a single individual such as we see everywhere, but repeatedly appeared both in garden and field, with well defined characters and from the same original stock. The origin of species by leaps is not new, but this confirmation is remarkable.

Prof. de Vries says that "it is much to be regretted that everywhere, in the manner of both working and thinking, deductive treatment has taken the place of observation and investigation. An immense superstructure of speculative science has risen on the foundation of Darwin's selection theory. The possible influence of selection in past times has been discussed for numerous cases, but its actual influence at the present time was left uninvestigated. Thought, instead of nature, became the source of theory, and the latter consequently became farther and farther removed from the truth.

At last the tide is turning. Conn, in a recent book on evolution exclaims: 'Let us leave our books and return to nature,' adding, 'leave speculation and turn to observation.'

Archaeology

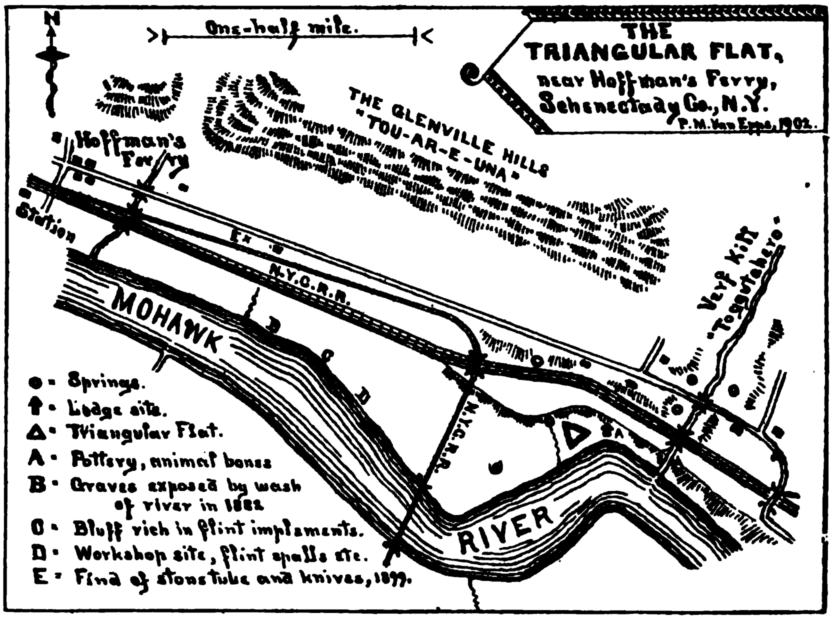
Edited by Warren K. Moorehead, M. A.

ABORIGINAL REMAINS IN LOWER MOHAWK VALLEY.

BY PERCY M. VAN EPPS.

II.

In this paper will be described some of the archæologic finds from a little tract of about four acres known to the local collectors as the Triangular Flat. It is an area of fertile river flats of triangular outline lying in a sheltered nook on the north bank of the Mohawk, near the mouth of a small stream, the Verf-Kill, or Toggutchero of the Indians, just one and one-fourth miles east of Hoffman's Ferry. Besides the peculiar abundance of triangular arrowheads many other interesting relics have here been obtained, and so far as yet known it is the only place in the Mohawk Valley proper from Amsterdam eastward where pottery fragments have been noticed.



Many situations in the beautiful Mohawk Valley give evidence of occupation by the red man. Wherever the many and fertile flats are broken by elevations of sand or gravel, or by slight knolls or ridges just a few feet above the general level of the surrounding flats, such situations are nearly always found plentifully strewn with spalls and chippings of flint. Many such situations have yielded large numbers of arrow and spearheads, knives, scrapers and other forms of chipped flint. Occasionally celts, pestles, gouges, etc., are found. Certain flint-strewn spots appear to have been workshops, for here are quantities of spalls and chips of the bluish black flint from which the majority of the flint implements of the region were made.

Among these masses of refuse occur occasional spalls of a pretty mottled flint, in color a creamy white with blotches of darker shades; these dark inclusions somewhat resemble the markings in moss agate, slightly dendritic in character. Arrowheads worked from this material occur in the vicinity, though rarely. Spalls of other colors and material occur, though not plentifully. Yellow jasper and white quartz chippings are quite rare. The very few arrowheads of white quartz found are evidently from other sections brought in the valley by warfare or in the way of barter.

As stated, the large majority of the workshop refuse is of a flint shading from a gray-blue to a dull black. Now, strange to say, with the numerous collectors and students of archæology in the valley and region, the quarry from whence this common and ever present material was gotten by the Indian is yet to be discovered. The ledge from which the mottled flint was had is, however, well known.

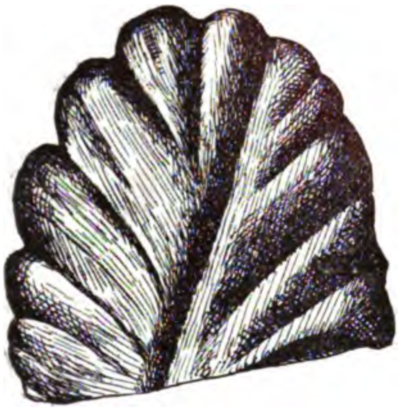
The subject of material used, the quarry sites, evidences of barter, etc., merits a special paper.

Pottery so abundant in central New York and the upper Mohawk valley is rarely found east of Amsterdam. Several camp or village sites, with the usual ash-beds and layers of mussel shells, are present, yet so far as explored they have yielded no potsherds save at one place, the subject of this paper. This site, having yielded so many small flint objects, has been and is yet, such a Mecca to the collectors of the vicinity that a short description will be not unmerited.

Just one mile below Hoffman's Ferry, the Mohawk river makes a sharp bend to the northeast. Inclosed to the southward by this right-angled bend, and with a steeply terraced ridge of gravel for its northern boundary, lies a fertile flat of perhaps forty acres. Upon the first step of the north-bounding terrace lie the four tracks of the N. Y. Central Railroad.

From this small tract of flats has been gathered during the last twenty years enough archæologic material to have fairly stocked a small museum, and when it is remembered that this tract has been cultivated continuously since early in the 18th century, only imagination can picture the fine relics that may have been picked up only to be scattered, lost or broken.

In the early days the phlegmatic Hollander probably cared but little for relics of the red man, for was he not a tangible reality to be dealt with—happily we can say—with uniform kindness and justice, though with a keen eye to the next season's stock of furs? Apropos, while searching for sites upon the extensive flats at Niskayuna, an aged laborer of evident Teutonic stock was approached and shown some arrow-heads with the query, had he seen such? He had, but always covered them from sight with his hoe; this in 1895. What peculiar shade of the elf-dart, thunder-stone superstition have we in this, an exotic from mid Europe?



SINEW-DRESSER.

Near the eastern end of the forty acres of flats described, the north-bounding gravel terrace curves slightly southward. Thus about four acres, constituting the extreme eastern end of the larger area, is, in a way, isolated and sheltered from the west by the ridge of gravel, which here is of considerable height. This little tract has been so rich in triangular arrow-heads that from this fact, as well as from the shape of the area, it has received from the local collectors the name "Triangular Flat." It is a curious fact that the very large majority, say ninety-five per cent., of all the arrow-heads found here are of the simple, unnotched, triangular form, while, beginning a few rods to the west, and over the whole area of the larger tract adjoining, all patterns of arrow-heads are found, notched ones predominating. An unusual number of small perforators (so-called) have been found, also numerous scrapers, nearly all in size rather less than those from sites to the westward. Mr. Albro Hallenbeck has in his collection twenty-nine of these scrapers, none larger than two inches in diameter. Among these Mr. Beauchamp noted one of a rare form with an edge worked to a slightly toothed or serrated outline by delicate secondary chipping.

A broken sinew-dresser with very deeply worn notches, of which an illustration is given, was found on the Trianguiar Flat in 1890. About the same date a rude block or slab of grit-stone was found having a well defined groove across one face; evidently for rounding or finishing arrow shafts. This object was of small size, evidently intended to be used as a hand tool. Several fixed boulders of large size, showing one or more such grooves have been noticed and described from the central and western part of the state.

The next or third paper of this series will treat of the single lodge-site and the distinctive Mohawk pottery of the Triangular Flat.

SLATE ORNAMENTS AND CEREMONIALS.

BY WARREN K. MOOREHEAD.

Correspondents have recently asked me where copies of my article upon ornament and ceremonial stones, published in 1894, could be procured. As the magazine in which this article appeared (The Archæologist) is now out of print, I have thought it best to reproduce the original in POPULAR SCIENCE NEWS. Illustrations are offered and some changes have been made in the text. This article was a part of a series entitled "Information for Collectors." To this series both Messrs. Berlin and Fowke (and others) contributed from time to time. I do not remember whether I furnished all the notes for this particular article or not. It is part of a series which began under my name. If I am appropriating another's notes I shall be glad to give him credit.

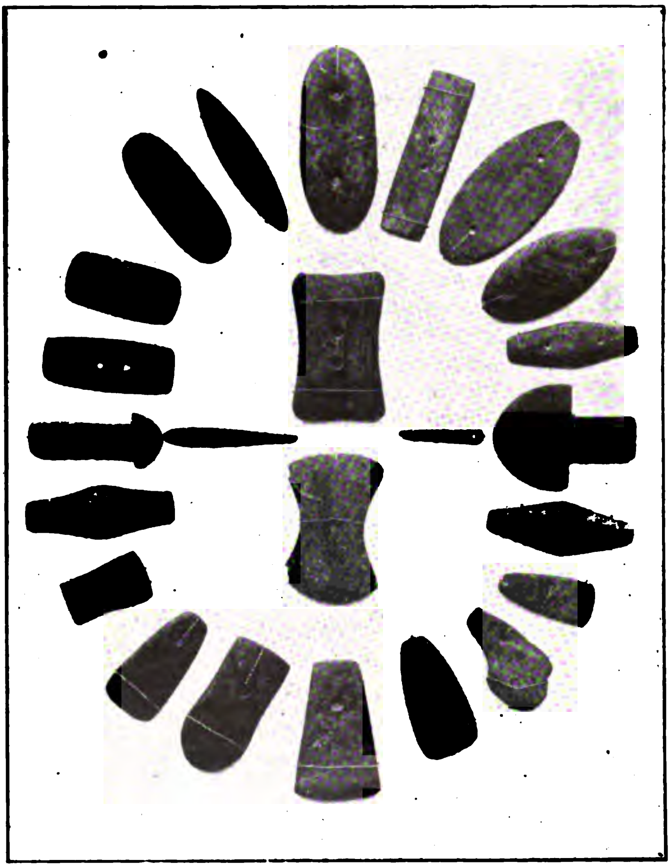


FIG. 2.—GROUP OF ORNAMENTS, ETC. GUTHRIE COLLECTION, INDIANA.
Material, slate. The apple form is rare.

With the exception of the finer pipes there is no class of relics that appeals to the collector, especially to the amateur, as do the beautiful specimens that must be considered ornamental or emblematic in character. They run through a wide range of form and material, though most of them are of the finest or most beautiful stone that was accessible to their fabricators. Many attempts have been made at a classification of these relics, but all have met with the insuperable objection, that, with very few exceptions, we are entirely ignorant of the uses to which they were put, and, consequently, have no starting point from which to extend our system of nomenclature. Even an attempt to name a few of the simpler forms presents a difficulty almost at the outset; for the different patterns graduate into each other imperceptibly, and there is no certain line of separation between specimens, which are, at first glance, entirely distinct from one another.

For example, as little as the flat, rectangular gorgets and the thin, hollowed, boat shaped stones resemble each other, there is no possible gradation between the two shapes that may not be found in any tolerably well-equipped museum. Even the cylindrical tubes and the thin, shapely butterfly banner stones may form the extremes of a series that shade into each other so insensibly that it is impossible to say where the one shape begins and the other ends.

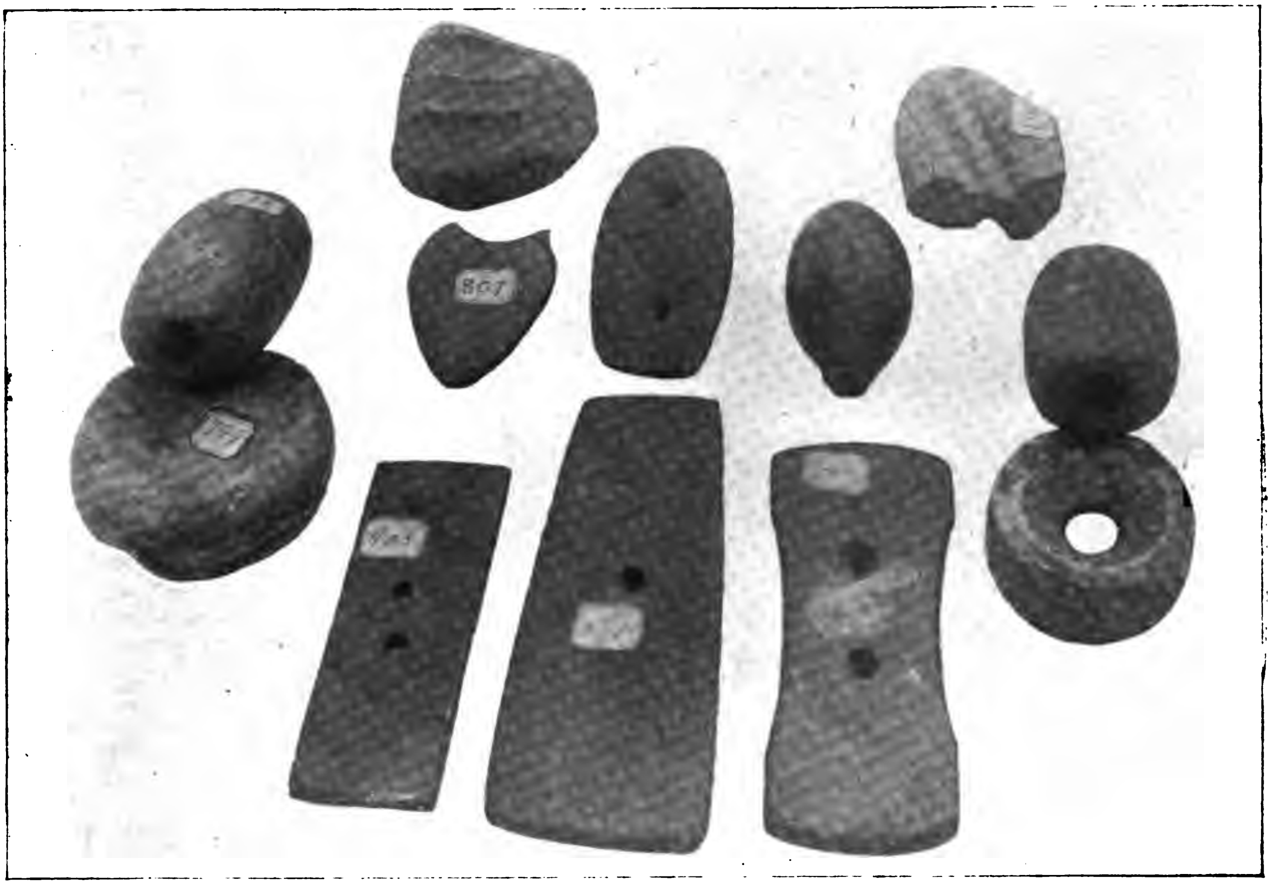


FIG. I.—ORNAMENTS, TUBES, BICAVE STONES, ETC WARREN COUNTY, OHIO.
Materials, slate and sandstone. Moorehead collection, 1889.

A multitude of names have been invented by various authors under which they have attempted to bring hundreds of different things into one general system, but most of these terms are, and must be misleading in their character; for, as a rule, we have no means of knowing to what use the specimens were put by their makers. To call the flat, perforated stones gorgets, because they are frequently found on the breasts of skeletons, and therefore probably answer the purpose for which such things have been worn in recent times, may be correct; but we have no warrant for saying that it is correct. We do not ourselves now make or use things so similar to the relics of our predecessors that we can classify our collections in the light of present knowledge; we cannot even say what we would probably do with such articles if we made them, because we do not make them, and, for the most part, never have made anything like them.

It would be a great help, not to collectors alone, but to the science of archæology, if some one competent for the task would establish an arbitrary system of nomenclature for all these things whose use is, and no doubt always will be, unknown. Such a method would be no more inexact than that which we are now compelled to use, and would at least have the merit of enabling one to understand to what an author referred when he used a particular term for a particular specimen or type. We do not have this knowledge at the present time, for every writer on the subject has his own way of designating whatever he wishes to describe, and thus we may have the same name given to two things that are entirely different, or have names not at all alike given to identical pieces.

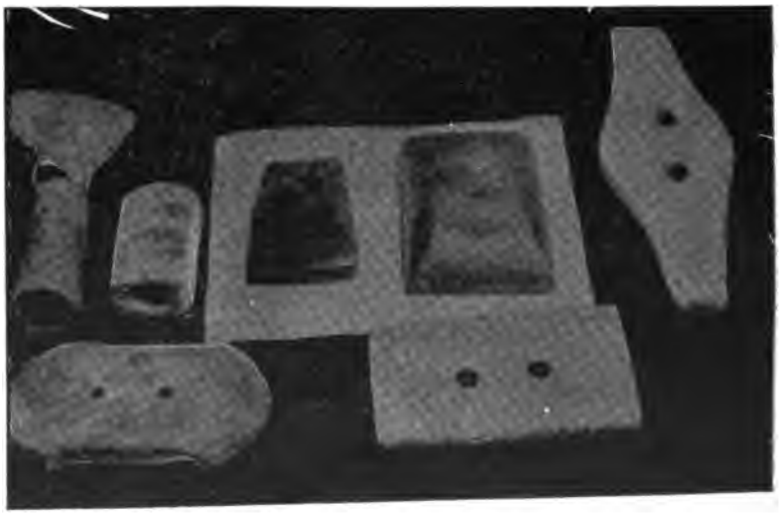


FIG. 3.—TABLETS, ETC. OHIO STATE ARCHÆOLOGICAL AND HISTORICAL SOC'Y COLLECTION.
Materials, slate and sandstone.

Unfortunately, the perfect specimens that may be classed as ornamental, are very rare; the material of which they are made is nearly always quite brittle, and the specimens are worked down to the last degree of thinness. Consequently, even if they may have been complete when lost or deposited with a body, the fragile substance of which they are made almost certainly ensures their breakage by the pick of the digger, the hoofs of stock, or the implement of the farmer. It is very seldom that a good specimen is to be found on the surface, and they are not much more common in the graves. Broken, imperfect, or unfinished pieces, however, are very abundant, and for the purposes of the student are as valuable as the more perfect ones—oftentimes more so, for there is less difficulty and expense in getting them.

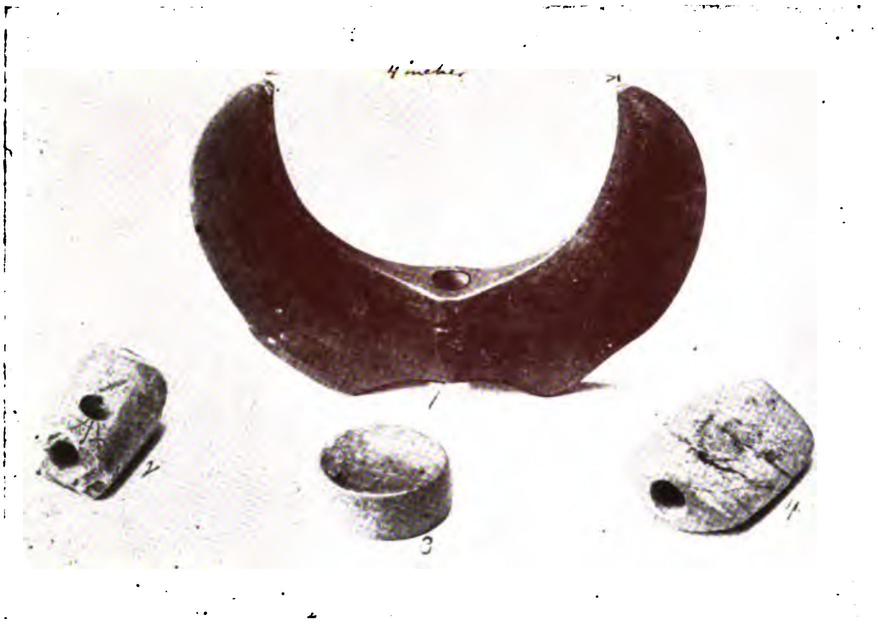


FIG. 4—DR. WORK COLLECTION, INDIANA.
1—Slate crescent. 2—Pipe. 3—Bicave stone. 4—Tube.

Without illustrations, it would be impossible to present here a clear idea of the different types that we wish to refer to; but any name given to a particular sort of specimen will be that in most common use by popular authors, so that those who have some acquaintance with the subject will readily understand what is meant in our descriptions or statements.

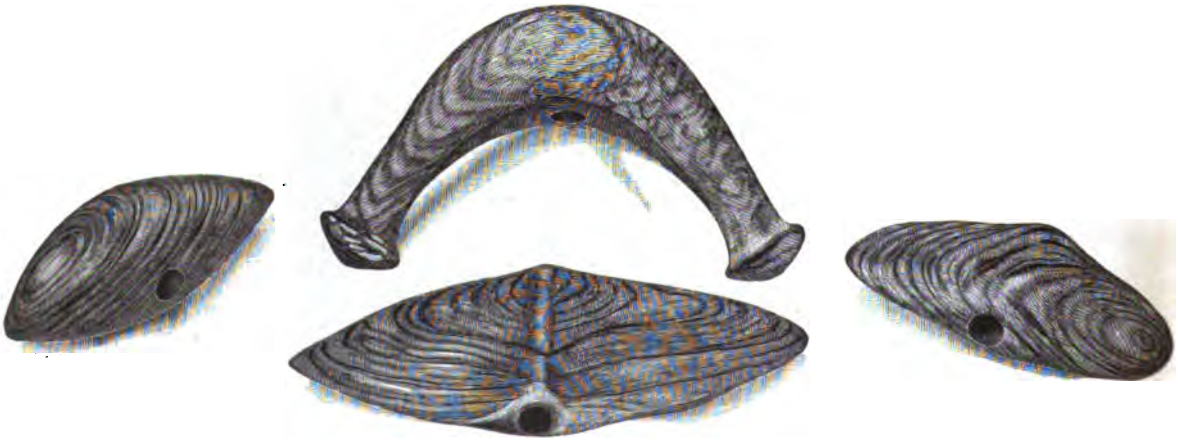


FIG. 5—HURLBUTT COLLECTION, ILLINOIS. MATERIAL, SLATE.

I will give a few particulars in regard to some of the more common forms:

TUBES.—These are usually of slate, though many are found of sandstone, and, very rarely, one made of quartz, or similar hard stone. The preference seems to have been for a material that was susceptible of a high polish. As a rule they are cylindrical, though some have one side flattened or even grooved. They vary from an inch to six inches in length; the majority, however, being less than four inches. The drilling was effected by means of a stick or cane, with sand. Unfinished specimens occur with a small core, showing the use of a cane or reed as a borer; in others the hole ends in a depression that proves the use of a solid stick. It is often stated that water was supplied with the sand, but this is a mistake, as by the action of the water the stick would soon become soft and wear rapidly, thus clogging the cavity and retarding the work. The drill may have been revolved between the hand or the bow may have been employed. Of course, two persons would be required to drill the longer or thinner specimens—one to work the drill, the other to steady the stone and direct the point of the instrument.

The banded Huronian slate was a favorite stone for this, as for other forms of ornamental appendages. It is soft enough to be easily worked, takes a good polish, and some of the pieces are really beautiful in their variegated markings.

(*To be continued.*)

Various Topics

LIGHTNING RODS.

BY ARTHUR K BARTLETT.

As the season of destructive thunder storms is again at hand, a few remarks concerning the electrical preservation of buildings will be opportune, and doubtless acceptable, particularly to those who are interested in the phenomena of lightning, and the best means of guarding against its devastations. Though much has been learned regarding the subject of atmospheric electricity since Benjamin Franklin drew the lightning from the clouds, yet the lightning-rod still remains practically the same as when first invented by this famous philosopher. It consists essentially of a rod of good conducting material, of sufficient area of cross section to safely carry to the ground the severest bolt that may fall in its locality. As nearly every person knows, it should project above the highest part of the building, and extend down its side into the ground. The upper part of the rod is furnished with one or more points of non-corrosive or unoxidizable metal, electrically connected with the material of the rod. Assuming the rod to be of good electrical conducting metal, and continuous throughout—that is, free from imperfect joints—the most important part of the rod is that which is out of sight, namely, the part which enters the ground.

If a lightning rod is to act properly as a protection to the building upon which it is placed, great care is always necessary in order to insure the lower end of the rod being placed in good electrical connection with the ground. For this purpose the rod should be sunk into the ground until permanently moist earth is reached, and it should also be enlarged where it enters such damp earth. If gas pipes are in the neighborhood, it is preferable that the rod be connected directly with them, and if the building on which the rod is placed is furnished with a tin or metallic roof, the rod should in all cases be electrically connected therewith.

Many curious ideas are prevalent in every community as to the action of the lightning rod, and the belief seems to be gradually gaining ground—at least among persons who have been imposed upon by nefarious and itinerant venders who have taken advantage of the prevailing ignorance regarding this valuable invention—that the lightning-rod is more a source of danger than of protection to a building. It is very important that the general public should know whether or not this is true, and the writer is pleased to say that this question is at present receiving the most careful attention from electrical experts. The overwhelming burden of testimony is in favor of the lightning-rod, which, if properly constructed and located, affords an absolute protection to the building; but, if improperly or poorly constructed, is unquestionably an absolute source of danger. Indeed, this is an almost self-evident proposition; for, since the function of the lightning-rod is to carry the bolt from the clouds to the ground, past the house, if the discharge once enters the rod and finds a difficulty in passing into the ground, it will undoubtedly wreak destruction on the building and its contents.

Since a lightning flash is merely a discharge between two contiguous clouds, or, as is very generally the case, from a cloud to the ground, objects nearest the cloud—that is, the tallest objects—are the most frequently "struck" by lightning. A ship at sea is for this reason particularly liable to the effects of lightning. Before the principles of electrical preservation were fully understood, the first effect of the application of lightning-rods to vessels was certainly attended with more evil than good; and this was especially the case with the men-of-war, from the effects of the discharge on the powder magazine. When Sir William Snow Harris, to whom we owe so many remarkable researches on electricity, first applied the true principles of electrical protection to ships, and showed that safety could be attained only by attaching the lightning-rod to the copper sheathing of the ship, and even to the masses of metal in the very powder magazine itself, he was fairly hooted by the English people, and it is said that he was accused of atheistic tendencies by the religious press; but when, after several years' trial, it transpired that none of the vessels protected by the Harris system were ever destroyed, the English people, by a somewhat characteristic somersault, changed their opinions, declared Harris a public benefactor, and even prevailed on the government to give him a baronetcy.

It is a curious fact that the iron ships of the present time are not damaged so frequently as are wooden ships. The German government has been collecting some statistics relating to the effect of lightning on ships, and the reason given, by the commission appointed to collect the figures, for the immunity of iron ships from damage, is that wire rope is used for rigging purposes, and that the vessels are constructed of either iron or steel. In this way it is believed that the whole ship becomes a continuous conductor, leading the lightning to the sea before it can do much damage. The commission also reports that no case has been recorded of a ship rigged with wire rigging sustaining damage from lightning, except in a few instances where a continuous connection had not been made with the hull. Wooden ships, on the contrary, still show the same percentage of casualties as formerly, when they are not fitted up with lightning-rods. The advantage of metal in the construction of ships, as a protection against lightning, was illustrated by the experience of the British steamer Congo, in December, 1890. A hurricane, accompanied with thunder and lightning, struck the vessel off the coast of Lisbon, and for a time her position was most critical. Everybody aboard, officers, crew and passengers, believed the steamer would go down, and orders were given to abandon the ship. The boats were provisioned, and they were just upon the point of being launched when lightning struck the vessel. This drove nearly all hands below, and before they dared to venture on deck again the lightning had struck several times. The iron plates, however, were excellent conductors, and the electric currents were carried into the water without doing any damage that endangered the ship. Some of the persons who remained on deck during this most dangerous period were stunned by the shocks, and several of them were more or less injured.

There has long been a difference of opinion among scientific men as to the origin of atmospheric electricity. But among the many causes, which have been mentioned to account for its presence, probably that of evaporation is the most satisfactory, and it is now quite generally believed that the process of separating the molecules of water so as to convert them from a liquid to a gas, produces an electrical charge in the disengaged vapor. If the condensation of this vapor follows in point of time sufficiently close to its evaporation, the condensation of the electrical charge causes results quite sufficient to account for the high potential of the lightning flash. In our latitude, and in fact in all parts of the world, severe lightning is unknown except under peculiar circumstances, where the condensation of moisture shortly follows its evaporation. For example, nearly all of our thunder storms, as is well known, occur at the close of the hottest days of the year. So, too, severe lightning is common in the equatorial regions and almost unknown in the high latitudes, while in desert regions, where rain never falls, thunder and lightning are absolutely unknown.

All the prominent electricians of this and other countries agree that lightning-rods, as they are now constructed, have a number of serious defects. In determining the requirements of lightning conductors, the manufacturers and erectors have neglected to properly investigate the peculiar properties of the electricity of the atmosphere and the earth and the lightning discharges which take place between them. In order to properly protect a building, its contents, and inmates, it is absolutely necessary that the metallic conductors be made many times the better path, so that the greater portion of the electricity in a lightning discharge will pass over it, and readily pass to the earth.

It has been fully demonstrated that the electricity in a heavy lightning discharge will not confine itself to the round iron rods, wire cables, spiral, twisted, and other peculiar and concentrated forms of lightning conductors heretofore employed. Proper protection can be effected only by applying broad and capacious metallic conductors to a building and in the earth, so that the electricity can be greatly diffused, and thereby disarmed, as it were, of its destructive energy.

Lightning discharges, which is electricity at a very high potential, are able to overcome ordinary resistance very readily. The fact is, that the difference between the conductivity of copper and iron in a lightning discharge is so small that it practically amounts to nothing. No person who is thoroughly acquainted with electrical science now believes either in insulation or metallic points in connection with a rod, though it is essential that the lightning should have a straight and broad path to moist earth or the subterranean water-bed. Every elevated portion of a building should be protected by a separate rod, and chimneys need especial care, because of the ascending column of vapor and smoke. The value of a lightning rod consists, most of all, in its power of quietly restoring the equilibrium between the earth and the clouds; and by erecting lightning rods, we thus lessen the liabilities of a sudden discharge. A rod is not intended to "draw the lightning," as commonly supposed, but actually to prevent its "striking" a building, by constantly maintaining a quiet circulation and exchange of opposite electricities between the clouds and the earth. It is not generally known that a lightning-rod is effective in protecting a building only at a distance of twice the height of the rod above the building, in every direction from the rod; and for this reason all large buildings should be provided with enough rods to afford entire protection from lightning during a severe thunderstorm. Kind Providence has guarded largely against the devastations caused by lightning, and a recent writer has well remarked: "God has made a harmless conductor in every leaf, spire of grass, and twig. A common blade of grass, pointed by Nature's exquisite workmanship, is three times more effective than the finest cambric needle, and a single pointed twig than the metallic point of the best-constructed rod. Every drop of rain, and every snowflake, falls charged with the electric force, and thus quietly disarms the clouds of their terror."

A prominent American electrician, who has for many years given his attention to the subject of lightning protection, advocates and recommends the following system: A metallic root connected with the ordinary rain-pipes, and an iron pipe two inches in diameter and from ten to twenty feet in length, perforated in two lines along its entire length, and driven into the earth and connected by an iron band with the rain-pipe, and so arranged that the water will flow into it and escape through the perforations, thus keeping the earth around the pipe always moist, and effecting a connection with the subterranean water-bed. Buildings with slate, shingle and gravel roofs may be protected by means of tin, galvanized iron, or other metallic bands, at least fourteen inches wide, and placed beneath such roofs, and connected in as direct a line as possible from the ridge of the roof to the rain-pipes. Metallic chimney-caps, ventilators, iron ornaments, etc., may be utilized for air terminals, or a suitable air terminal may be erected, and it matters not whether it is pointed or blunt. An electrical discharge that can easily pass through two miles of air (which is a poor conductor), and twenty feet of solid rock, will certainly not stop at trifles in the shape of points, rust, paint, etc.

Lightning seldom, if ever, goes below the top floor of a house provided with gas or water pipe, or below the uppermost floor that contains them. In a wooden house not provided with pipes, it is more difficult to state its course beforehand, though it will generally strike the chimney, and end at the well or drain if near the house; its course through the house being governed by the amount of moisture in the different timbers, plaster, etc., in the absence of any metal conductor.

Sir William Snow Harris, whom we have already mentioned, is perhaps the best authority on lightning-rods, and, probably to be on the safe side, he recommends a large rod. He advises the use of a rod three quarters of an inch in diameter, though he admits that probably never in the experience of mankind has a rod one-half inch in diameter been melted, and in every case where a rod a quarter inch in diameter has been melted it has been in the form of a chain. This, of course, giving small connecting points between the links, offers great resistance, and consequently great heat and explosions at every link. There is little doubt that a solid iron wire, one-quarter of an inch in diameter, will conduct any ordinary charge of lightning in safety, observing the necessary arrangements, the most important of which is the ground connection. Every lightning-rod should be of one piece throughout, fastened vertically to the roof of the building, and thence carried down into the ground. The lower extremity should part into two or three branches bent away from the house, and carried sufficiently far into the soil to meet water or permanently moist earth. The conductor should be connected with all metallic surfaces on the roof or other parts of the building, in order to prevent the occurrence of lateral discharges, or discharges from the conductor to these surfaces, which are often very destructive.

EARTHQUAKES.

BY J. L. WELLINGTON.

Earthquakes are movements of the crust of the earth. In intensity they vary from a gentle, scarcely perceptible motion to the most violent undulation, changing the surface of the earth and overthrowing the most substantial works of man. New lakes and river courses have been known to form from these seismic disturbances, and old ones obliterated.

There are three kinds of earthquakes called from their respective motions, the wave-like or undulating, the vertical, and the rotary. The first is the most common and least destructive. In this kind, the waves either advance in a straight line or spread from a central point like waves from the spot where a stone is dropped into the water. The earthquakes of the Andes regions are said to be principally of this class. They are propagated along the mountains with the undulations perpendicular to the range. The vertical acts from beneath like an explosion, and when they are violent nothing can withstand their force. The rotary is most destructive but happily is rarest. Both of these latter two are supposed to be only the various systems of waves intersecting each other. The rotary earthquake has been known to twist fields into each other and to change their places entirely. The velocity with which the earthquake wave moves varies, but is estimated at from twenty-three to thirty-two miles a minute.

Great earthquakes usually consist of a series of shocks repeated at longer or shorter intervals during a period of several months and years. After the earthquake on the coast of Venzuela in October, 1766, which destroyed the city of Cumana in a few minutes, the earth continued to be shaken almost every hour for fourteen months; but this is not remarkable in comparison with the one on the island of Sicily in the year 1783, which continued to agitate the island for ten years.

Although no part of the earth is free from earthquakes, they are most frequent in what is known as the volcanic belt—the coastal regions of the Pacific Ocean, and in the vicinity of the great transversal belt, called the zone of fracture. This zone of fracture includes the Gulf of Mexico, the Mediterranean Sea, and separates the northern from the southern continent. Though situated in this latter belt, Egypt has, perhaps, been less visited than any other country with earthquakes, and even here we have the record of one which occurred in 1740 A. D. Holland, with its soft, alluvial soil, has also felt their power. Nor is the bed of the ocean exempt Vessels have passed over the point of greatest disturbance just at the moment of the greatest shock. In like manner earthquakes have been active at every period of the earth's existence, breaking up its solid crust, elevating or depressing its surface and doing as much as any other single agent to bring it into its present condition.

Within the tropics, earthquakes are most frequent during that part of the year when the greatest atmospheric disturbances take place. They are most dreaded at the beginning of the rainy season. At this time, in some places, the inhabitants forsake their houses and live in bamboo huts or tents until the danger is past. Observation has shown that earthquakes are most frequent when the combined attraction of the sun and the moon act together on the earth; also, during an earthquake the shocks are most frequent when the moon is on the meridian.

Among the indications of approach of an earthquake are aspects of the heavens, changes in the atmosphere, irregularities in the season preceding the shock, sudden gusts of wind interrupted by calms, violent rains at unusual seasons, underground noises, haziness in the air, often continued for months, reddening of the sun, and similar phenomena.

No satisfactory explanation of the phenomenon of earthquakes has yet been offered. Local disturbances preceding or following a volcanic eruption are no doubt due to the action of the volcano; but all that take place outside of volcanic districts, especially those general ones which disturb hundreds or thousands of miles in extent, must be ascribed to some more general cause. This cause may be found in the constant cooling and contracting of the heated mass in the earth's interior, thereby increasing the tension of the strata of the earth and the hardened outer crust. In this case, every difference of pressure upon the earth's crust, whether arising from atmospheric or astronomical causes, may have a share in the production of earthquakes.

More than 13,000,000 of people are estimated to have lost their lives by earthquakes. The most appalling disaster of this character was that at Lisbon, Portugal, November 1, 1755, when more than 60,000 people perished. The day was the festival of All Saints and the churches were full to overflowing. Between nine and ten o'clock in the morning a rumbling noise was heard like distant thunder. It gradually increased until it resembled the sound of heavy artillery. A faint shock was followed by a heavier one and in six minutes 30,000 persons were buried under the churches and other edifices. The ground seemed to undulate like the waves of the sea, the surrounding mountains were seen to rock violently upon their bases, and huge chasms opened in the earth and closed again. One of the most remarkable features of this earthquake was the area over which it was felt. All western Europe was agitated, and northern Africa suffered considerably. Nearly all the cities of Morocco were destroyed and fissures from which issued streams of water were opened in many places. On some of the islands of the West Indies the seas rose twenty feet; a similar rise was observed in the harbors of New York and Boston. The entire surface disturbed by this earthquake is estimated to be four times the area of all Europe.

Earthquakes have been common throughout the geological ages. Like glaciers and volcanoes they are not to be thought strange or peculiar, but are a normal phase of the earth's development.

PYRITE.

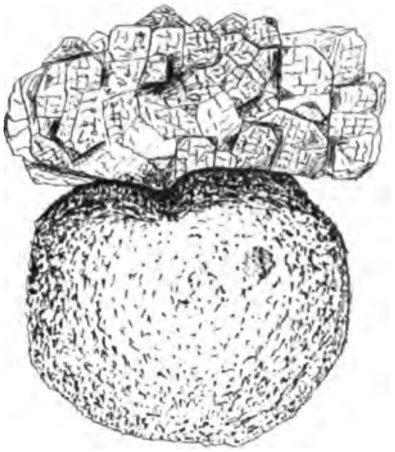
BY ROY HOPPING.

Pyrite or iron pyrites is sulphide of iron and one of the most common and widely distributed minerals. It is light brass yellow, although ,often tarnished deep golden on an exposed or weathered surface. Rarely it is beautifully iridescent. It usually occurs in small brilliant cubic crystals sprinkled through the gangue rock or else in crystalline granular masses. At many western localities splendid groups of large crystals are not uncommon.

Pyrite is absolutely worthless as an ore of iron, and should not be considered as an iron compound, but as a sulphur bearing mineral. It is used for making sulphate of iron, called copperas or green vitriol and sulphuric acid, known commercially as oil of vitriol. When it occurs in large beds it is mined for the latter purpose, the United States producing over 150,000 tons yearly. The mineral is roasted in closed furnaces and the fumes carried through pipes into lead chambers jetted with live steam. The condensed water is concentrated to the brown impure commercial oil of vitriol so extensively used for various purposes. Pyrite is in many mines a rich auriferous sulphuret, often the only ore in many rich gold mines.

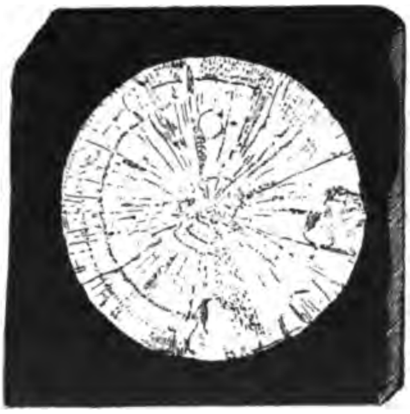
Pyrite has long enjoyed the honor of the name "fool's gold." Its brilliant color, together with the fact that it is unaffected by acids, brings it often to the laboratory of the assayer. It is easily distinguished from gold, for it is quite hard, brittle, has a greenish black streak and strikes fire with steel, while gold is soft, malleable, and has a shining golden streak.

Chalcopyrite or copper pyrites is not so easily distinguished from pyrite, although it is usually a rich golden-yellow and more often tarnished than pyrite. They often, in fact generally, occur together, sometimes so intimately mixed as to be inseparable to the naked eye. Both have a greenish black streak, and if heated before the blow-pipe they become magnetic, as they both contain considerable iron. Pyrite, however, is hard, while chalcopyrite is soft enough to be cut with a knife.



SULPHUR BALL, PYRITE CONCRETION. NEW JERSEY.

Pyrite concretions are not uncommon, and fig. 1 is a "sulphur ball" from the cretaceous brick and potter's clay of Middlesex Co., New Jersey, where they occur in great numbers, of various sizes and shapes, often very peculiar and grotesque. Specimens resembling frog's heads with bulging eyes, alligators, etc., are not uncommon. These concretions consist of an inner nucleus generally quite spherical, with a smooth surface of small bright drusy crystals. Over this ball is a cap of large cubic crystals or several bunches of large crystals stuck on at different places.



PYRITE "SUN" IN COAL SHALE. ILLINOIS.

A still prettier concretion is the pyrite "sun" or disc, found in the soft coal shale of Randolph Co., Ill. This resembles a large gold coin set in the flat tablet of black "slate." It has a drusy center with deep gutters radiating to the edges. They seem to be simple flattened concretions, but when broken these "suns" reveal the fact that they consist of two large, flat, slightly convex discs with a thin plate of black shale separating them. There is also a short crystalline columnar structure perpendicular to the surface of the disc. It is not unlikely that the pyrite occupies the place that was formerly occupied by the shell of a sea urchin or some similarly shaped form of animal life. The drusy center, radiating lines and a series of concentric circles make the probability plausible.

Another peculiar form of pyrite is found at the noted roofing slate quarries of Lehesten, Germany. Between the cleavage plates of the slate the pyrite is found in delicately traced fern and tree-like forms—dendritic it is called.

In the Pennsylvania coal region pyrite is often met with in the so-called coal "slate," which is really a shale. It occurs in thin layers, and when the free surface consists of small cubic crystals it is very brilliant. Under the name "sulphur diamond" it is mounted for jewelry and is often remarkably beautiful.

Firedamp and Afterdamp.

In accidents like that which occurred recently in the Cambria mines, and which resulted in the loss of many lives, two kinds of gas are concerned. One is popularly known as firedamp, and is called marsh gas by chemists. The other is afterdamp, and is a product of explosion. The former, when pure, is made up of carbon and hydrogen, in the proportion of one atom of the former to four of the latter. Mixed with air, it behaves like acetylene, naphtha and other hydro-carbon vapors. It is highly explosive, and takes fire on slight provocation. The two chemical elements composing the firedamp are separated by combustion, and each forms a new association with the oxygen of the air. The hydrogen thus produces a small quantity of water, which is harmless. The carbon makes carbon dioxide, or carbonic acid gas, which is the afterdamp of the mines. This is odorless, but it suffocates those who breathe it. Firedamp, being a trifle lighter than the air, shows a disposition to accumulate along the upper part of the workings, whereas afterdamp, having a greater density, sinks to the floor. Unless powerful ventilating fans can be brought into play it cannot be dislodged from the mine.

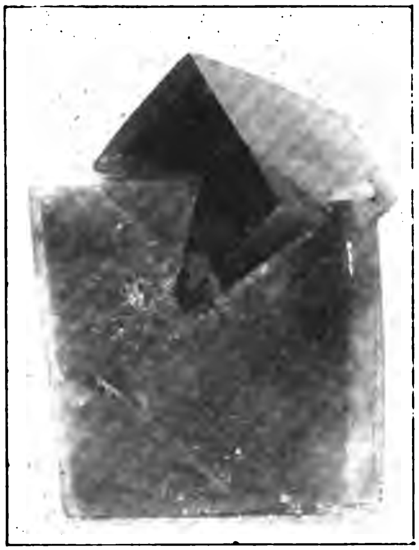
Twilight Duration.

The text-books say that twilight is short in the tropics. But this is now condemned as a myth. At the Harvard observatory at Arequipa, Peru, June 25 the sun set at 5.30. As late as 6.40—1 hour and 10 minutes after—the light was still sufficient to cast a shadow. Twilight lasts nearly until the sun is 18° below the horizon. This takes longer in the higher latitudes than nearer the equator, but even in the tropics the light of day does not "go out like a lamp."

Minerals

[Edited by A. C. Bates].

Fluorite.—It is perhaps safe to place fluorite third in the list of popular mineral specimens; quartz and calcite being first and second respectively. The variety of colors, sharpness of angles and exquisite groupings of the crystals together with their transparency, all help to give to fluorite its place in popular esteem.



PURPLE FLUORITE—WEARSDALE, ENG.

Green, purple, white, bluish and yellow are the commonest colors, with pink rare and then usually in the scarce octahedral form of this mineral. Fluorite is composed of fluorine 48.9, calcium 51.1. Chlorine is sometimes present in minute quantities.

Isometric. Habit cubic, less frequently octahedral, with many modifications. Also massive, compact and granular. Penetration twins are common. Cleavage is perfect, cubes readily yielding octahedrons under expert blows. Shows double refraction with varying degrees of intensity and is remarkably adaptive to the construction of apochromatic lenses because of its low refractive and dispersive powers. Fluorite is a necessary flux in the smelting of some ores, and is the base of hydrofluoric acid, which is used for the etching of glass.

Gem stones are sometimes cut from clear pieces of fine color, but fluorite is too soft (hardness 4) for wear.

In the North of England fluorite is the gangue of the lead veins which intersect the coal formations in several counties, and it is from these mines that the great abundance of beautiful groups of cubic crystals have come. Sometimes these groups are sprinkled over with small, bright crystals of quartz or calcite, or both, and the contrast with the darker colored fluorite renders the specimens very attractive. In some mines the groups of fluorite occur, sprinkled with a bistre-colored siderite, which is not removable, and this does not add beauty to the underlying mineral. The cubes of this region vary in size from minute dimensions to eight inches square, and usually occur in groups; isolated crystals on the gangue being comparatively rare. The massive variety of mixed colors is in Derbyshire worked up into various objects, as balls, vases, cups and saucers, etc.

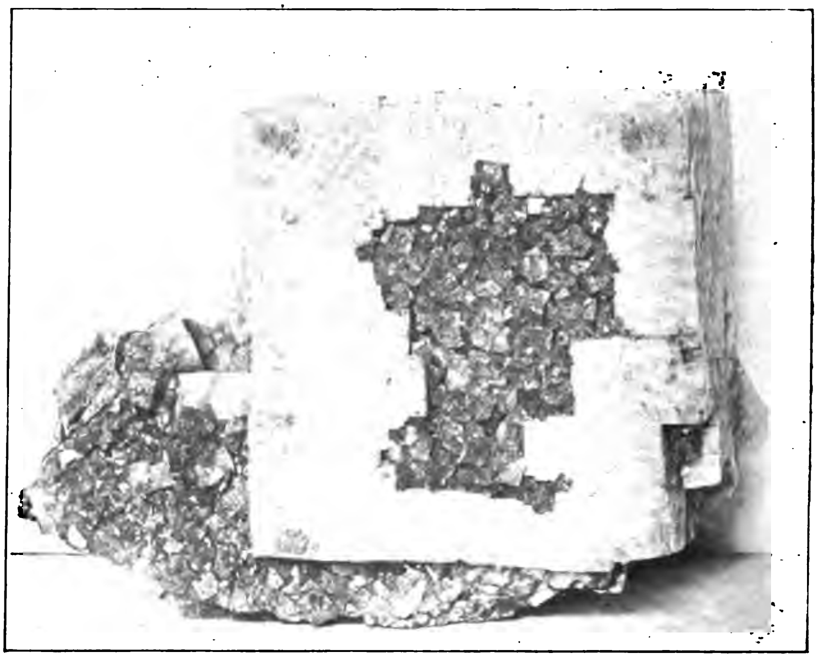
ELONGATED CRYSTAL OF FLUORITE, ENGLAND.

In the dolomites of St. Gothard occur the pink octahedrons so much prized by collectors, and one may pay fifty dollars for a small group of these crystals.

The best known American locality to yield an abundance of specimens is the one near Mascalonge Lake, Jefferson Co., N. Y. Here were found giant cubes of grass-green color, and so plentifully that specimen material was pulverized for use in nearby smelters. There are several American localities yielding small lots of fair specimens, the chief one being in New Hampshire. A fairly representative suit of colors and forms in good specimens may be had at from three to fifteen dollars.

Cuprite.—Ruby copper crystals of good size and quality have recently been found in a vein rich in values in the Calumet and Arizona mine near Bisbee, Arizona.

Astrophyllite is a titano-orthosilicate of iron, manganese, potassium and sodium, and occurs abundantly with zircon and other minerals at St. Peter's Dome, Pikes Peak, Col. Its color is a bronze-yellow with a pearly lustre, is micaceous and occurs in long, thin blades in a rusty quartz matrix. It is is in no sense a popular mineral, not because it is unattractive, but because perfect crystals are rare. Astrophyllite is one of the minerals sold to tourists at fancy prices at various places in Colorado. People interested in collecting mineral specimens soon learn that it is more satisfactory, and much cheaper, to buy of the few regular dealers in minerals than it is to patronize the generally unreliable fakirs at popular resorts. There should be a satisfaction in buying specimens when one visits well-known localities, but when it is known that not all the quartz crystals occur in Arkansas that are offered for sale as such at Hot Springs, and that not a piece of satinspar offered at Niagara Falls as "mined from under the Falls," occurs there, but is imported from England, this knowledge and the large prices asked should make one turn to reliable dealers for their needs.



FLUORITE AND SIDERITE—CUMBERLAND, ENGLAND.

Agate.—It is reported that a large vein of banded and mottled agate has been found on Chickies Ridge, near Columbia, Lancaster Co., Pa. Masses have been uncovered large enough for stand and table tops. Agate has been found in several nearby counties, but the newly found deposit is by far larger than any other in the state, and perhaps in the United States..

"Josephineite" is a new mineral and is so named because found in the ancient Illinois River Channel, Waldo District, Josephine Co., Ore. In lustre and weight it resembles nickel mixed with platinum, and occurs in nuggets of varying size in large quantities on the serpentine bedrock of the Meredith Hydraulic Mines. The exact analysis of the mineral is now being determined.

Black Marble.—The remarkable find near Fort Bowie, Arizona, of a large deposit of several kinds of marble, including a large streak of black marble, has led to exaggerated conclusions of the value of the latter article. Black marble of high grade is not uncommon in the United States. There are several known deposits which would be developed if the demand warranted. Black marble is used for the trimmings of white or mottled marble, wainscotings, and clock and mantle ornaments.

Coal. On February 11, 1802, Jesse Fell, of Wilkes Barre, in the presence of various notabilities of the town, publicly demonstrated the use of coal as fuel. The grate then first used in the test, still exists, it is said, in place in its chimney.

Action of Light on Precious Stones.—It is known that violet light from an electric arc lamp excites fluorescence in the diamond. M. Chaumet has proved that an intimate connection exists between that property of the diamond and the lustre exhibited in other artificial lights, especially the light from candles (in which the diamond shows to the greatest advantage.) The diamonds that send out the most vivid rays are not always those which are the most regularly cut, but are such as, examined by violet light, show the greatest fluorescence. While diamonds that do not fluoresce simply show violet when so illuminated, the most brilliant stones fluoresce strongly with a clear and very brilliant blue radiation. The test is of practical value and has been applied to other precious stones—yellow diamonds, Burmese and Siamese rubies, etc.

Massive Mining Shaft.—The Red Jacket vertical shaft of the Calumet and Hecla is but little less than a mile in depth, and is equipped with a duplex hoist of 8,000 horse power and ten boilers of 1,000 horse power each. This plant, for the operation of a single shaft among the eighteen on the mine, develops more horse power than is required to run the entire street car system of the city of Buffalo.

At the deep vertical shafts of the Calumet and Hecla, and Tamarack mines, there are hoists that raise loads of six to ten tons, vertically, at the rate of thirty to fifty miles per hour.

Hall's Journal of Health

Founded by Dr. Wm. M. Hall, 1854.

VENTILATION OF MIDDLE-CLASS DWELLINGS.

BY FRED. T. HODGSON.

In the construction of dwellings of medium character, it is not necessary to expend a large sum of money in an elaborate system of ventilation. Indeed, expensive systems are rarely successful, and in very few cases satisfactory.

"Successful ventilation" is the term applied to the means by which, without draught, vitiated air is diluted or removed from a room and fresh air supplied; it is intimately connected with the heating and cooling of the air supplied to the room Warming is required in winter, and it is preferable that the air should be warmed before entering the room, as by this system draughts are less frequent, and it is considered that the inlets for fresh air, under these circumstances, should be kept low, but not in the floor, and not exceeding eight feet above the floor. An open fire-place is one of the best devices known for changing the air in ordinary rooms.

It is not wise to admit air at too low a temperature into a room when the air is warm, or when many persons are congregated, as this will immediately cause a draught. In winter the air should be warmed to 55 or 60 degrees before it enters the room to produce the best results. To obtain cooling, the outlets must be high up, but not necessarily in the ceiling. The top of the openings should not be more than 12 feet from the floor, and 10 feet is better, as it is the strata of air in the breathing zone that requires removing and renewing, rather than the air above.

There are two systems of ventilation, viz., natural and artificial The latter may be subdivided, depending upon the means employed to bring about the changes in the air. Mechanical ventilation is undoubtedly the best and most certain method of insuring a regular supply of air, through an expensive, and often an inconvenient method. In any case, horizontal through currents give the best all-round results; that is to say, the air should enter on one side and go out at the other; or at the ends and go out at the centre; or at the centre and go out at the ends. The main body of a wind moves horizontally, though there are plenty of eddies in it, and the same action, in miniature, occurs in ventilated rooms.

Draughts make themselves felt from two causes—the speed and the temperature of the air in the current; at a speed of 1⅓ feet a second—one mile an hour—air at the temperature of 60 degrees is not felt as a draught by ordinary people; and a greater speed should be avoided either by closing registers, if any, or shutting off the outlet.

The theoretical minimum of air required in each house for one person sedentarilly engaged is 3,600 cubic feet, or one foot per second. All this air is not breathed, of course; most of it is needed to dilute and carry away the carbon dioxide, vapor, organisms and heat exhaled by the lungs and skin. It is costly to warm this large volume of air in winter, as we are made aware by the demands made by our heaters, stoves and fireplaces..

Air higher than 12 feet above a floor is of no service, indeed, it is better to have ceilings less than over 12 feet high, as the body of air above that point is rather a detriment than otherwise, to good ventilation.

Air is a mixture of various gases; it is not a chemical compound. Its normal temperature in the shade, in this country, may vary from 15 degrees below zero in winter, to 100 degrees above it in summer, according to time of year, and locality. Its humidity or dampness varies from thick fog, 100 per cent., down to as low as 36 per cent., in bright summer weather. Hence, in winter we may warm and dry air to a considerable extent, and still have natural air.

Natural ventilation is that derived from the wind. It is powerful, but irregular and unreliable. In summer it will give satisfaction, especially with open windows; but in winter it can be used only to cool rooms lighted by gas, or very crowded with people. Open windows are the best means of natural ventilation. Special inlets, such as short metal panels and brackets, with registers attached, should be provided in those buildings whose occupants will not open the windows. The best windows for ventilating are the double hung sashes; the worst are the casement windows. The best transom light for ventilating is the horizontal swivel, next, that hinged at the top, and regulated by a transom litter. The worst is the transom that is hinged at the bottom.

Outlets in the ceiling are not absolutely necessary in every case; it depends entirely on the height of the ceiling above the floor. To be successful, ventilation must remove the air from the zone in which the people move.

FOOD IN NEW FORM.

An important discovery in economic botany, which it is believed will have a very far-reaching application to human food, was announced at one of the conferences of heads of departments, visiting botanists, etc., which are held weekly in the museum building of the New York Botanical Garden.

The author of the discovery is Dr. Alexander P. Anderson, now curator of the herbarium at Columbia University. The discovery may be described as a dry process of cooking cereal grains and starchy products. Realizing the importance of investigations along this line, he began in the spring of 1901 a series of experiments on the effect of temperatures of 100 degrees and above on the cereal grains, to determine what effect dry heat under different conditions would have on the starch granules.

When air-dry powdered starches, like corn starch, tapioca flour, sago flour or starchy preparations like pearl sago and pearl tapioca, are treated, the resulting swelled dry white masses become enlarged copies of the original, which increases in volume from six to nine times. When pure starches are thus treated and expanded, and the resulting dry products afterward placed in water, they go into suspension, forming a starch paste similar in every respect to one formed by boiling starch in water.

The only difference between starch paste or starchy food products prepared by the ordinary methods of boiling, or cooking with water, and the dry method of expanding them, is that the resulting products expanded when dry can be kept indefinitely in their dry condition, while the products prepared with water easily spoil and ferment when not afterward sterilized and kept in closed vessels.

The dry method is simply a dry cooking process, where the air-dry starchy products and air-dry cereal grains are taken and, after a short period of heating in a saturated atmosphere, at a temperature not exceeding that of the baker's oven, come out in a dry state, thoroughly and uniformly cooked, as well as absolutely sterilized.

Dr. Anderson says that his process may be varied to produce a great variety of flavors with any given cereal, by regulating the degree and duration of the heat applied. The products can, of course, be salted or otherwise seasoned or artificially flavored either at the time of the process or afterward, to suit individual tastes.

Pearl barley, once treated, is all ready to be used for thickening soups and would be palatable with cream or milk. The expanded rice grains could be prepared like salted almonds or sugar-coated as a confection, or placed in hot milk, ready as a table vegetable or for invalids' food.

On account of their great digestibility it is believed that the products of the new process would have a very high value simply as foods for invalids and dyspeptics. It is also declared that most of them would form ideal foods for infants. By the saving in the amount of starch ordinarily wasted a large addition is made, it is said, to the nutritive value of the foods, and a saving is thus effected in the amount required for proper sustenance.

It is further pointed out that the keeping qualities of the dry-cooked products, which are averred to be equal to the raw grains under the same conditions, together with their compressibility when desired into very small compass, particularly fit these foods for ship stores, army supplies and the use of travellers, explorers and others in such regions as the Klondike.

Use of Water at Meals.

Dr. Felix L. Oswald insists that the avoidance of water at meals is a mere "sanitary superstition." It is not possible for any normally constituted human being to eat his way to the first quarter instalment of a modern dinner of overheated made dishes and greasy viands without experiencing a distinct longing for a cooling diluent, and before the end of the second course that craving assumes the urgency of positive distress, but the sufferer is warned to forbear. Has not Professor Orthodox enumerated five distinct sources of peril from indulging that appetency, and proved that the water instinct is wrong, and that nature knows nothing about it?

The most specious of those arguments is the alleged risk that the introduction of cold water would coagulate the albumen of the ingesta, and thus complicate the labors of the digestive organs. But is it not evident that those organs should be allowed a casting vote in the decision of that controversy?

Dr. Schrodt, the author of "Natur-Heilkunde," holds on the contrary, that our diet is not half fluid enough, and demonstrates that organic warmth will soon reduce over cold beverages to the right medium, and that a craving which nothing but fresh water will satisfy is a clear proof that the stomach is suffering from an excess of caloric and deficiency of moisture.

Just wait, and that distress will subside, insists Professor O——x. Yes; the subtle chemistry of the organism will eventually find means to satisfy its needs from internal sources, just as the agony of a famished man will give way to a dull torpor; the system has made another forced loan on the reserve stores of its own tissues, and made the sufferer a little more comfortable, though also a little leaner. Even thus the disappointed stomach will make shift to lead moisture from some other part of the organism where it is less sorely needed and the distress subsides, though a feeling of vague discomfort remains, suggesting that the sort of moisture reabsorbed from the lower alimentary duct is not exactly what the stomach wanted.

Test the Drinking Water.

The supply of drinking water for the family should be tested at least once a year. Water that at one time is pure and wholesome may become too impure for use, yet it may be without color, and have no odor or taste to show its dangerous qualities.

A single test of drinking water is the Meisch sewage test. Fill a clean pint bottle three-quarters full of the water to be tested, and dissolve in it half a teaspoonful of granulated sugar. Cork it and set it in a warm place for two days. If during this time it becomes cloudy or milky it is unfit for domestic use. If it remains perfectly clean it is probably safe. Be careful that the bottle is absolutely as clean as you can make it and the sugar pure.

The second test is also a simple one. Obtain from a trustworthy druggist about five cents' worth of saturated solution of permanganate of potassium. Add about five drops of this to a pint bottle of water. This will turn the water a beautiful rose purple. If there is any considerable amount of organic matter, the color will give place in the course of a few hours to a more or less dirty reddish-brown. If the color of the water in the bottle remains for twelve hours unchanged from the rose purple it assumed when the permanganate of potassium was first added, it may be considered free from organic contamination.—Health.

New Cure for Tuberculosis.

The announcement made recently to the Berlin Academy of Sciences, by Prof. Emil von Behring, of the results of his researches in consumption is of the deepest import. Prof. Behring's notable act in turning over the Nobel prize of $40,000 to the medical research institution he has founded at Marburg, was recently noted in the papers; his standing in the scientific world, his discovery of the diphtheria serum, stamp his judgment with the highest authority. Briefly, as the result of six years' investigation, Prof. Behring finds that the tuberculosis in man and in cattle (and other animals) is one and the same disease—originating with one and the same germ. This, it need hardly be said, is diametrically opposed to the views of the famous Dr. Koch, of Berlin. Prof. Behring has found that the disease-bearing germ is altered in passing from the blood of man to cattle, or the reverse; hence the confusion that has existed. But what is most important is that Prof. Behring has been able to inoculate very young animals, and has obtained from these an antitoxine serum, after the manner that the smallpox vaccine is cultivated.

Apples for Sleeplessness.

The apple is such a common fruit that very few persons are familiar with its remarkably efficacious medicinal properties. Everybody ought to know that the very best thing they can do is to eat apples just before retiring for the night. Persons uninitiated in the mysteries of the fruit are liable to throw up their hands in horror at the visions of dyspepsia which such a suggestion may summon up, but no harm can come even to a delicate system by the eating of ripe and juicy apples before going to bed. The apple is excellent brain food because it has more phosphoric acid in easily digested shape than any other fruits. It excites the action of the liver, promotes sound and healthy sleep, and thoroughly disinfects the mouth. This is not all; the apple prevents indigestion and throat diseases.

Photography

IMPROVEMENT OF NEGATIVES.

BY JOHN HADDEN.

In spite of all that has been written regarding the improvement of negatives a large majority of photographers do little or nothing in this line of work, seeming to think that with the development, fixation and washing of the negative the work on it is finished; and a great many of them, while realizing that there are methods of improving the printing qualities of their negatives, do not care to take the time or trouble to do so, hence the frequent excuses we hear for poor prints from negatives which properly treated would give good pictures. Intensification and reduction are the best known and most frequently practiced methods of improving negatives. It is not my intention here, however, to make more than passing reference to these, so much having been written on the subject. Another method, frequently used but regarding which we see little written, is that of backing up the negative with onionskin paper and working thereon with crayon or pencil. Before applying the paper to the back of the negative it should be dampened, and when dry will be found to be stretched quite tight and smooth. By working on the paper with pencil or crayon it is very easy to brighten up a highlight here and there, or reduce the density of a shadow and bring the negative up to even printing quality. While it may take some time and care to do the work, it is a much better plan than "dodging" the negative for each individual print, and will result in prints of more uniform quality, and is really a saving of time in the end. For working on the paper backing I prefer to use a light and dark yellow crayon, especially for the shadows.

It often happens, however, that work along these lines fails to give the desired result. There is, fortunately, another method of improving negatives regarding which we hear but little, and it is to this I particularly wish to refer. It is a pretty well-known fact among lantern slide makers that a negative which does not give a good print may be made to yield a good lantern slide or transparency. Taking advantage of this fact we can from this lantern slide or transparency produce in turn a negative of good printing quality. This work may be done either by making the transparency and resulting negative by contact or by reproduction in the camera I prefer the latter plan, which has an additional advantage in that an enlarged negative can be made from the transparency. Whichever plan is followed the plates in all the operations should be backed. For instance, suppose we have a negative which even after intensification gives a print flat and lacking contrast, we proceed to make from this negative a transparency, either by contact or by reproduction in the camera, as stated above, using for the purpose a slow lantern-slide plate, the tendency of a slow plate being to give increased contrast. Lanternslide workers will readily determine as to the exposure to give, but with the novice one or two trials will probably be necessary to get the exact time. It must be kept in mind that our aim is to secure contrast in the transparency, and the exposure must be given with this object in view. This fact must also be borne in mind in developing, therefore we must choose a developer which will aid us in this effort, such as pyro or hydroquinone, and regulate the development accordingly.

Amateur Photo by N. W. Emmens. "HOMEWARD BOUND."

If, on the contrary, we have a negative too great contrast we must work along opposite lines, using a rapid plate and a developer which tends towards softness, such as metol and amidol. Having secured a satisfactory transparency we proceed to make therefrom a new negative, working along the same lines as in making the transparency, using a slow plate if still further contrast is required, and a fast plate to gain softness. Those who have not tried this method will be surprised at the great difference in the prints from the original and reproduced negatives. The method sounds complicated, but is not remarkably difficult in operation, and often results in the saving of a poor negative which cannot for one reason or another be secured again.—Camera and Dark Room.

PHOTOGRAPHIC NOTES.

The amateur photograph business has developed until a trust has just been formed, with $35,000,000 capital, covering the best of the American field, with the Kodak people in full control of the situation.

* * *

If the rubber bulb and tubing begins to harden, immersion for a time in spirits of turpentine will often soften it.

* * *

Always take care to keep the lens clean, for in summer there is much more dust in the air, and a dusty lens usually means a blurred or foggy negative.

* * *

Special care should be taken of apparatus and chemicals during the hot season Keep the camera and plate-holders in a cool, dry place, where there is no danger of the wood-work swelling or warping.

* * *

When you are taking a landscape, in which trees and hedges, water courses, and sheep and cows are the principl features, a little distortion does not make much difference. But if you are taking a house or a cathedral, anything in the way of distortion would be fatal.

* * *

Down Town Topics says that rigidity is of paramount importance to the landscape worker if he desires to work in comfort and obtain negatives free from the blurring caused by tremor. To obtain this rigidity of the outfit when set up for work, it is necessary to expend care and thought in the selection of the tripod. A good tripod is one of the rarest things in the realm of photography. Let any of our readers set up their camera, then take hold of the front of the baseboard, and try the rigidity of the whole in a horizontal direction. If any motion can be imparted to the whole by the exertion of gentle force, the tripod is at fault, and sharp negatives cannot be expected when the wind is blowing hard.

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THE METRIC SYSTEM.

There are so many weights and measures in common use in the United States, that it may be safely said that few people are familiar with all of them. The three different systems of weight, the apothecary, troy, and avoirdupois, illustrate this fact. And while the yard may be stated as our standard of length, we find in practice various arbitrary multiples of the yard and foot, as the fathom, the surveyor's and engineer's chains and links, the nautical mile or "knot," the statute mile, hands, perches, etc.

Besides the ordinary cubic measure, we find three systems of measuring capacity; dry measure, liquid measure and apothecary's fluid measure. And to these could be added a number of technical standards in common use in various trades which would be greatly simplified upon the adoption of the metric, or international system of weights and measures.

The unit of length in the metric system, known as the "meter" is defined as one ten-millionth part of the distance from the equator to the pole of the earth, measured on a meridian. The French Government was the first to construct one of these units, and was based on measurements known to be the best at that time.

The unit of mass, or weight, is the kilogram, and is defined as the mass of a cubic decimeter of pure water at a specified temperature. The fact that the meter is only approximately a natural standard as originally intended, has been used as an objection to the metric system. This objection is not important, since the meter and kilogram can be constructed as permanent as the standard now in use, and the tremendous advantage of having weights and measures expressed in terms that may be added, subtracted, multiplied or divided at almost a glance, besides the international adoption, far outweighs the fact that we have no natural standard.

Although years ago the United States government sanctioned the use of the system, Congress has lately agitated the question of adopting it in the various government departments. The vast extension of our international business renders the adoption of a common system quite indispensable. The metric system is so much more logical and accurate than the older one, that its employment will facilitate measurements in countless ways.

THE HEAVENS FOR AUGUST.

BY PROF. MALCOLM McNEILL.

The constellations,—Lyra will be found very near the zenith and Cygnus to the east, with most of the constellation a little north of Lyra; Cassiopeia is in the northeast at about the same altitude as the pole star. Perseus is rising below Cassiopeia. Andromeda is well up in the northeast, and Pegasus is due east about half way from horizon to zenith. Pisces is rising near the east point, Aquarius and Capricorn are in the southeast, and Sagittarius is low down on the south meridian. Aquila is above it while Scorpio and Libra are low in the southwest. Virgo is setting in the west, while Bootes and Corona are higher up in the same quarter, and Hercules is still nearer to the zenith. Ursa Major is in the northwest below the altitude of the pole star. The Milky Way is still in fine position, the portion through Cygnus and Sagittarius being especially rich in stars when examined through a small telescope.

Phases of the Moon, Eastern time:

New Moon.	Aug.	3.	3 h. 17 m. P.M.
First Quarter,	"	10,	11 h. 24 m. P.M.
Full Moon,	"	19.	1 h. 3 m. A.M.
Last Quarter,	"	26.	6 h. 4 m. A.M.

Mercury is a morning star at the beginning of the month, rising about an hour before sunrise. It is therefore too near the sun to be easily seen by the naked eye, and its apparent distance diminishes rapidly until August 11, when it reaches superior conjunction with the sun and passes behind it. It is not actually occulted by the sun as the planet is then in that part of its orbit which is farthest from the ecliptic, and its nearest apparent approach to the sun is more than one degree. After conjunction it becomes an evening star and its apparent distance from the sun increases, but it does not get far enough away before the end of the month to be seen as an evening star.

Venus is also a morning star, rising about two and one-half hours before sunrise on August 1, but this interval diminishes to about two hours during the month. It moves about 44° eastward and southward among the stars during the month, from the constellation Gemini through Cancer, into Leo, and draws about 11° closer to the sun. It will reach superior conjunction with the sun toward the close of November.

Mars rises at about 2.30 A.M. on August 1, and at 2.05 A.M. on September 1. It is therefore getting far enough away from the sun to be be easily seen, although it has not yet begun to be conspicuous. It moves about 22° eastward and southward among the stars through Gemini into Cancer. It is on August 1 a little more than 1° north of Venus; but the more rapid eastward motion of Venus causes a rapid separation of the planets. The actual distance of Mars from the earth has begun to diminish, but it is still more than twice the distance of the earth from the sun, and hence the planet has not yet begun to be much brighter than it was at its minimum. However, it will be rather brighter than the pole star, and may easily be distinguished by its ruddy color.

Jupiter is in opposition with the sun on August 5, and is consequently above the horizon nearly the entire night throughout the month. It is in the constellation Capricorn, and retrogrades (moves westward) about 4° during the month.

Saturn is in the same quarter of the heavens, about 20° west of Jupiter. It passed opposition with the sun on July 20, and like Jupiter, is retrograding among the stars, but at only about half the speed, so that the two planets approach each other about 2° during the month. This approach will continue until October and then the planets will begin to separate again. As seen in the telescope, the minor axis of the ring is decidedly smaller than it was during the opposition of last year.

Uranus is in the southwestern sky in the evening, setting at 1 A.M. on August 1, and at 11 P.M. on September 1. It is still in the southern extension of Ophiuchus between Scorpio and Sagittarius, and is nearly stationary throughout the month, moving slowly westward until August 27, and then beginning to move eastward; no very bright star is near enough to furnish an easy identification.

The annual Perseid meteor shower is due during the early days of August. Probably the greatest number will be seen about August 10, but a half hour's watch on any evening before August 20 will show several. This shower, while not as rich as the November showers, comes every year. As seen by the name of the shower, the radiant is in the constellation Perseus on the dates when the shower is richest. This is low in the northeast in the evening, but toward morning the constellation has moved nearly to the zenith. The meteors are usually seen in greater numbers between midnight and morning.

Intelligence of Ants.

Dr. Schroeder, the German entomologist, tells of a striking case of ant intelligence. He placed some sticky fly paper in front of an ant hill, where the ants would have to pass over it. They did not fall into the trap, however, but brought grass, sand, etc., and strewed them on the sticky surface, thus making a bridge over which they could pass.

Correspondence

Notes on Crayfish.

Editor POPULAR SCIENCE NEWS:

Not far away from where I live, is a somewhat low, flat piece of land, with numerous little structures scattered over it, known as crayfish chimneys. Some varieties of these have been described and illustrated in a former number of POPULAR SCIENCE NEWS. But several interesting facts failed to find their way into that article, and I will endeavor to describe some that were omitted.

Strolling about, I first noticed that on the lower part of the ground, adjoining the sluggish ditch that runs through the "flat," the chimneys were small, mishapen, and generally not open, while on higher ground, the chimneys were tall, well made, and most frequently "open." Investigation showed that the burrows first mentioned, were made by a small black crayfish, with immense "claws," and the burrows were shallow; in fact, seldom over six inches deep. Further, the contents of the burrow are generally muddy. Soon after a drought has set in, these crayfish enveloped in dried mud, become torpid, and await the next rain before commencing life again.

But on the higher ground, as we have mentioned, the chimneys are higher, and open. A glance at them shows that they are composed of (in part at most) the subsoil. A bullet attached to a thread, and let down, reveals a depth of three to four feet, and even occasionally six feet. A spade vigorously handled, showed that the hole is generally about half full of clear water, and when the crayfish is finally secured, it is seen to be a lovely creature. Brilliant scarlet and blue, relieve the monotony of his coloring, and render him as handsome an animal as can be be found Before digging the crayfish up, we note that around the chimney, at distances of generally about a foot, are from two to five holes, about the same diameter as that forming the chimney. These holes end with the surface of the earth, i. e., they have no chimney surmounting them.

The thought naturally comes up, why do some crayfish have chimneys whilst others have none? But our spade reveals the fact that all these holes communicate with the hole over which the chimney is situated. Generally the main hole is perpendicular, while the simple holes radiate from the main hole like the branches of a tree.

On investigation, we find this to be always the case, and a crayfish's home ceases to be the simple structure we at first imagined it to be. Next comes the question, why these radiating holes? A theory advanced is that they might be serviceable to the crayfish when escaping from enemies. The idea being that the crayfish "grazes" at night on the herbage surrounding its hole, and obviously the more holes to be retreated into the better when Mr. "Coon" comes around.

Another is, that these holes are traps, i. e., they provide hiding places for crickets, etc., and while hiding from other enemies, the crayfish comes up behind and gobbles up the unfortunate refugee. This theory has been demolished (?) by some students by the remark that this species of crayfish is strictly vegetarian. In reply I can only say that as a barefooted schoolboy I have often lured these vegetarians to their death by the simple expedient of a bit of bacon tied to a string and let down in smelling distance of the crayfish. Again I have often left two crayfish in a basin of water over night. Next morning there would be in the basin one very fat crayfish, and sundry claws and such other remnants of the other. Probably these animals had heard that "all flesh is as grass," who knows?

A theory of my own, however, is as follows. In the nature of the case, crayfish holes are liable to be inundated after heavy rains. If these holes consisted of a single tube, and happpened to lay in the route of a muddy rivulet of water, the inevitable consequence would be that the sand and silt would be deposited in the hole, and the owner must either get out or be buried. On the other hand, the orifice of one of the several holes constituting a well regulated crayfish's house, must be lower than another. Consequently, the overflowing stream will run down one hole and out of the other, and carry its silt with it (filling up, it may be, the lower end only). What country boy has not seen this happen hundreds of times?

Enough of theory, however, let us turn again to solid facts. To dig a hole four feet deep to get a crayfish is quite a job. (If my reader don't think so, let him try it.) One crayfish a day is about all that the average naturalist will care to accomplish. I will give him a recipe whereby he may get fifty. It is to dig a shallow funnel above the main hole (about one foot deep). Make a bucket of muddy water of soup like consistence. Pour it down, and fill up both the "hole" and the funnel; then be quiet. In a few minutes you will notice a commotion, and directly you will see the feelers of the crayfish moving about in the mud. Grab him, and drop him in your bucket, and go to another burrow. By this means the "price" of Cambarus ludovicianus has been reduced from one dollar to perhaps ten cents in this vicinity.

Having secured him, and washed him, he is a beautiful animal. Put him on the ground, or on the floor, and he will put up a glorious, alert and watchful fight! Then drop him in a bucket of water, and he will generally give a series of violent backward flops of his tail. This done, he will then subside, become quiet, and you can't scare him. Contrast his behavior with that of a crayfish taken out of an open brook, the latter is easily frightened; any sudden motion toward him will make him dart backward. But not so with our burrowing species.

Experience for ages gone by, has taught him that when he is in water, he is safe. Therefore, as soon as he feels himself in water, he feels that his whole duty is done. Nothing else can be done by him when in danger, except to drop "kerplunk" into his burrow. But with the creek crayfish it is different. Most of his enemies live in the water, about him. Eternal vigilance is his watchword, and rapid, erratic motions constitute the means of saving his life. What a magnificent opportunity this gives for argument? Instinct, reason, materialism. Does the crayfish think? Or does his Creator think for him? Or does he behave in these various ways because of a "fortuitous concourse of atoms" in his economy?

Who can answer these thoughts suggested by our humble crayfish? God alone! Tyndall says that we can't tell whether a crayfish can think or not, unless we could turn into crayfish and try it on! So I suppose the problem belongs to the unknowable. LORRAINE S. FRIERSON.

The Ant Lion of Michigan.

Editor POPULAR SCIENCE NEWS:

The Ant Lion is the larva of a neuropteral fly, which resembles the dragon-flies, but is smaller. This larva is remarkable for its habits, and the manner it obtains food. In Europe this fly is only found on the Continent, and not in the British Isles. I was not aware that an American species of this fly had been found in the States; and for years I have inspected sandy locations to see if some congener of this fly, or the fly itself did not inhabit Michigan. I found no signs of it until last August. I saw in the sand, under a Norway spruce tree, some funnel shaped holes, which I concluded then, were made by other insects, as I examined them and found no larva. This I found out later was because the larva, in this Michigan kind, is a timid thing, and will play possum as soon as disturbed, and as they are a plain brownish color, they pass for any old piece of debris that is in the sand.

A few days later I noticed quite a number of the holes in the same locality. These were from one to two inches across at the top, and from one to one and a half inches deep, and came to a point at the bottom. These holes vary in size, with size of the larva, which no doubt depends on age, as some, as I afterwards found out, were as much as three-quarters of an inch long, while others were not half that length. The larva lies covered in the sand at the bottom of the hole, his strong mandibles at the point. In seizing his prey he never uncovers himself, but as soon as it touches the bottom, it is fastened there in a vice-like grasp He is unlike his cousin across the water, in regalia, being very plain, but has the heavy mandibles and head of his congener.

When one of these holes becomes filled up, in any way, the ant lion plows it up and throws out the sand with his head until the hole is complete for business. He throws the remains of his victims out of the pit, by a jerky movement of the head. This funnel-shaped hole is his ant catcher, and answers the purpose of the spider's web to secure a living. I dropped an ant into one of these holes, and as he struggled up the sides to escape, falling back a little at times in the loose sand, the larva threw up the sand from the bottom with his head, in a jerking manner, which falling on the ant, soon sent him to the bottom, where he was quickly seized by the creature. This larva is called Ant Lion, because ants are its principal food. I do not know the duration of the larval state in this species, but in the European variety it is about two years.

F. B. HALL.

Lehigh Valley Relics.

Editor POPULAR SCIENCE NEWS:

The January issue of POPULAR SCIENCE NEWS contains an article relative to a Lehigh Valley Indian Site, by Harry J. Ivey. I was especially interested in that portion relating to figure 6. Mr. Ivey says of it: "This specimen belongs to the stemless variety; it has been variously classed as a knife, scraper and spear-head. It will be noticed that on the least convex edge is a semi-circular indentation, which as can readily be seen, is not the result of an accident, it being nicely chipped; it was presumably designed to be used as a crescent stone."

This is the first instance of my attention having been called in print to such an indentation, although I have carefully examined them upon several relics in my collection, and agree with Mr. Ivey that they are not the result of an accident, but were carefully chipped to serve some purpose. Two of the specimens in my collection are almost identical in form to that in the illustration, the only important exception being upon that part described by Mr. Ivey as "suitable for use as a scraper."

It is plainly to be seen that my two specimens were formerly supplied with stems that have been broken, and I think it probable that the level base of Mr. Ivey's relic was caused by an exceptional break which left no trace of stem or shoulders. It appears to me that these small crescent indentations are too insignificant to support the supposition that the instrument was used as a ceremonial.

I consider them flesh and skinning knives, the stems of which have been broken by excessive pressure, for it occurs to me that the sharp corners of the crescent would well serve the purpose of severing tough ligaments, tendons and arteries.

LINCOLN MICHL.

A Novel Birdnest.

Editor POPULAR SCIENCE NEWS:

Bird architecture is always interesting to the student of nature, and the peculiarities and oddities of structure and material which are occasionally indulged in by our feathered friends are especially so.

In the early spring in Minnesota I had a bird's nest banded me which was decidedly unique and novel, and I question if there was ever a duplicate. Who its builder was, I was unable to determine, but its size and general appearance indicated that it was the work of a member of the sparrow family. It was built in the usual proportions with closely woven grass, string, etc. In the bottom of the nest, spread out carefully, was a piece of cloth about one and a half inches in diameter. All around the upper edge of the nest was placed small hen's feathers, the quill end of which were firmly secured, the edges just over-lapping and all curving inward, thus forming a complete canopy over the nest.

M. G. JENISON.

Collecting of Froth and Foam.

Editor POPULAR SCIENCE NEWS:

In your issue of February, 1902, J. Mayne Baltimore asks, 'Why is it that foam and froth collects in streams in greater quantities during the night than in the daytime?"

In reply, I ask, does that occur on days which are cloudy as well as on clear days? If the answer is yes, then I have no more to say. If no, then the problem is solveable on the theory that the dryer air of the clear day—there being no dew—takes up the moisture in the foam as fast as the bubbles form. That may be one explanation for the phenomenon.

BAYER, U. S.

New Element Discovered.

The Sun reports that Prof. Marckwald of the Berlin University announced at the last meeting of the Physical Society that he had discovered a new element. It is called radion. It is active and of extraordinary energy. Professor Marckwald has separated it from radioactive bismuth, so-called polonium found in uranium ore.

It consists, as Prof. Marckwald discovered, substantially of ordinary bismuth and of a new metal in the proportion of a thousand to one. The new metal can be separated by the electrolytic process. The rays it emits are something like those of the metal radium, but differ in being almost completely absorbed by paper as well as by glass.

Prof. Marckwald has proved that a porcelain tube heavily charged with electricity by rubbing, immediately lowers its charge when a morsel of this metal weighing hardly a milligramme is brought within a distance of one decimetre. A chemical analysis of the new metal is rendered very difficult by the fact that one ton of ore contains hardly one gramme of it.

Questions and Answers

QUESTIONS NOT ANSWERED.

Answers are solicited, especially for all questions so far without replies. Questions will appear but twice, successively. The following questions needs reply—366, 371-378.

380. New Cement. Several months ago a statement was made in the Digest that Edison had perfected a new cement, equal to the Portland cement, but much cheaper, which would revolutionize building by enabling houses to be constructed of this "poured" cement. Is such a cement now manufactured, and if so, where?

M. S. W.

383. Pipe-Stem. Can any of your readers tell me how the hole is made in crooked pipe stems; sometimes the amber and the wood as well are both so bent that it is impossible to bore a hole through either with any ordinary tool.

A J. L.

384. Mosquitoes and Germs. We hear a great deal nowadays about mosquitoes carrying malaria germs, but little is said as to how the germs originate. Is the mosquito in any way responsible for their origin? Possibly one of the M.D.'s among your readers can enlighten me upon this subject.

J. M.

385. Transplanting Trees. What is the proper way to transplant young trees?

C. H.

386. Hydrocarbons and Carbohydrates. What is the difference between these two things, or are they the same?

PETE ROLEUM.

387. Pink Clover. Is a pink clover, in size between red and white clover, only a variety of the latter, which often turns pink?

G. J.

388. Robins. Do robins hear or see movements of worms beneath the surface of the ground, when they stand watching for worms?

L. T. M.

389. Automobiles and Horses. Who has tried leading horses to an automobile, and moving the machine enough to make its peculiar noise? Nervous horses can be accustomed to anything, even a thundering railroad train. Usually horses need only to come close to an object and smell it, to overcome their fear.

MECHANIC.

390. Peat for Fuel. There is plenty of it. Why not substitute it for high-priced coal, either as found or as compressed into something very like coal?

ANN THRACITE.

391. Stammering. What is the best cure for stammering?

TUT.

392. Deafness. Can any of your readers give a remedy for slight senile deafness, or any instrument besides the old trumpet that will improve the hearing. I have heard there are such; if so, where can they be obtained?

COLLINGWOOD.

393. Freckles. Perhaps some reader of POPULAR SCIENCE NEWS can give a remedy for the disfigurement known as freckles. What causes freckles to appear, and what is a good method of removing them?

394. Insomnia. Please give a good remedy for sleeplessness. Counting sheep jumping over a fence, and other old-fashioned means of inducing sleep only seem to add to the restless pitching and tossing. Can anyone give a remedy for the trouble? N. G. S.

ANSWERS.

370. Size of Telescopes. Here is a list of those in existence in 1900 Refractors: Paris (Exhibition), 50in.; Yerkes, 40in.; Lick, 36in.; Pulkowa, 30in.; Nice, 29.9in.; Paris, 28 9in.; Greenwich, 28in.; Vienna, 27in.; Washington, U. S., 26in.; Leander McCormick Observatory, Virginia, 26in.; Greenwich, 26in.; Newall's Cambridge, 25in.; Cape of Good Hope, 24in.; Harvard, 24in.; Princeton, N. J., U. S., 23in: Mount Etna, 21·8in.; Strassburg, 19·1in.; Milan, 19·1in.; (Dearborn), Chicago, 18·5 in.; Warner Observatory, Rochester, U. S., 16in.; Washburn Observatory, Madison, Wis., 15·5in; Edinburgh, 15·1in.; Brussels, 15·1in.; Madrid, 15in.; Rio Janeiro, 15in.; Paris, 15in.; Sir William Huggins, 15in.; Paris, 15in. Reflectors: Lord Rosse, 6ft.; Dr. Common, 5ft.; Melbourne, 4ft.; Paris, 4ft.; Meudon, 3ft. 3in.; South Kensington, 3ft.; Crossley (Lick), 3ft.; Greenwich, 2ft. 6in.; South Kensington, 2ft. 6in. P. Q.

372. Typewriter Ribbon. The following process is recommended. Take vaseline of high boiling point, melt on slow boiler or fire, incorporate by constant stirring as much lampblack or powder deep black as taken up without becoming granular. If fat remains in excess the print is liable to have greasy outline, if color is in excess, print will not be clear. Remove mixture from fire, and while cooling mix equal parts of petroleum, benzine, and rectified oil of turpentine, in which dissolve the fatty ink, introduced in small quantities by constant agitation. The volatile solvents take in such quantities that the fluid ink is of consistence of fresh oil paint. One secret of success lies in the proper application of ink to ribbon. Wind ribbon on piece of cardboard, spread on table several layers of newspapers, then unwind ribbon in such lengths as convenient, and lay it flat on paper. Apply ink, after agitation, by soft brush, rub it well into interstices of ribbon by toothbrush. Hardly any ink should remain visible on surface, For colored inks, use Prussian blue, red lead, etc., and especially aniline colors. Aniline black, ⅛ oz., pure alcohol, 15 oz., concentrated glycerine, 15 oz. Dissolve aniline black in alcohol, add the glycerine. Ink as before.

R. Park.

373. Cold in the Head. A little vial of carbolic acid, full strength, held to the nose so as to breathe the vapor, will relieve a cold in the head. But here are three other recommendations from the English Mechanic.

An old and effective cure is to go without drink of any kind for 48 hours, and which I have personally proved. Some advise the inhalation of hartshorn, seven or eight times in five minutes; also spirits of camphor same way. Also feet in hot water and 80 grains of Dover powder, i. e., ipecacuanha, 1 dr., powdered opium, 1 dr., powdered saltpetre, 1 oz., all well mixed; hot drink, and plenty of blankets.

Another cure is this: Push a piece of zinc ointment well up in the nostril and work it about. Jabez.

374. Substance of Comets. A Fellow of the Royal Astronomical Society has this to say in reply to some one's statement that the generally-accepted view among astronomers is that comets are nothing more nor less than mere bundles of meteoroids. I should like to say that I am old enough to remember the glorious apparition of Donati's Comet in 1858, and well recollect the (almost enhanced) brilliancy of Arcturus, as it shone through many thousands of miles of the very nucleus of the comet. One would be curious to know how its light got through such a number of cubic miles of mineral particles closely aggregated. Bear in mind that the mist from a pond would have blotted out the star altogether. A. K.

375. Excessive Blooming. It is an old problem, so far only answered by saying that Nature provides an excess of seeds because many come to nothing. I have a similar Judas tree; only a few of the flowers have become pods. Observer.

376. Substitute for Quinine. In my family, India Cholagogue has been very successful against malaria, but I do not know its composition. Perhaps it contains quinine. J. R. W.

377. Swelling of Fingers. The swelling of the fingers referred to by R. I. is caused by the change in temperature affecting the capillaries or small blood vessels supplying the skin. Cold contracts them and drives the blood from the surface; heat dilates them, and with this increased supply of blood, there is a slight swelling of the skin surface, accompanied with effusions of water or perspiration.

John Howard, M.D.

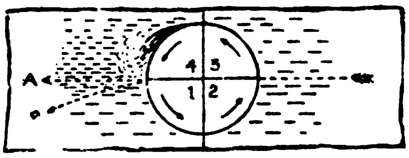
382. Tarnished Silver. It is the sulphur in the egg which turns the silver black. And it is sulphur or sulphuretted hydrogen in the air which tarnishes the silver which is put away. The best way to keep such pieces bright is to obtain tissue paper from jewelers or manufacturers of silverware, as it is more free from sulphur than others. Place a piece of camphor gum in the dish or outside if a closed piece, wrapping several thicknesses of tissue paper about both, then a thick paper, closing it securely. Place the package as near the floor as possible, for the air is purer there, as gases which cause the tarnishing, being lighter, rise. Mrs. W. W. White.

CURRENT MENTION.

Why a Baseball Curves.

In answer to a correspondent, the Pathfinder explains how the ball curves as follows: The "curve" a ball takes when thrown is a result, of course, of the twist the pitcher gives it; so much is popularly understood, but this does not explain the science of the operation.

Any object when thrown, with no twist, tends to follow a straight path, except for the attraction of gravitation which gradually brings it to the earth. A pitcher, however, can make a ball curve upward, or to one side or the other, or downward, by twisting it in the corresponding direction as it leaves his hand.



Look at the illustration. The ball is being thrown apparently in the direction A, but the pitcher has given it an over twist which makes it curve down in the direction B (here exaggerated). Why this rotary motion in this direction makes the ball drop will be readily seen when the principle is once pointed out.

Suppose the ball divided into four quarters, numbered 1, 2, 3, 4. The surface of quadrant 1 is moving in a backward direction, or opposite that of the flight of the ball, thus reducing the friction from the air at that part of the ball's surface. Nearly all of the front part of the surface of the quadrant 2 is running in an opposite direction to the line of flight of the ball and reducing the surface friction at that point also.

The surface of the quadrant 3 is running generally in the same direction as the line of flight of the ball; but it will be noticed that as the surfaces of both of these rear quadrants are running in the comparative vacuum made by the forward movement of the whole ball, there is practically no friction on any portion of the back half.

But it is what is taking place on the surface of the fourth quadrant that governs the direction of the ball. This surface is meeting the direct opposition of the air in front of it and instead of running away from that opposition as the first quadrant does, runs with greater or less directness against it, and thus not only develops much greater friction at this point but also condenses or solidifies the air in that vicinity. In short, the rotary motion of the ball increases the friction on the surface of the fourth quadrant and lessens the friction on the other quadrants. As it is an inviolable rule of physics that objects in motion take the line of the least resistance, it follows that our baseball gradually edges away from the point of greatest pressure, namely, the vicinity of the surface of the fourth quadrant, and is thus diverted from the direct or initial line of the flight into a gradually curving line downward.

Fungus Attacking Man.

There is a curious instance of a pathological saprophyte in the disease known as actinomycosis, caused by the presence in the tissues of the human being of the fungus actinomyces, the mycelia of which penetrate into and between the cells, bringing about the formation of multiple abscesses in various parts of the body. The botanical aspect of this case is very interesting, as it shows us that other organisms besides Schizomycetes may infest animals and produce pathological results.

The symbiotic relations are very striking, for we see that this saprophyte directs its action especially towards animal tissues, whereas in most cases (lichens, etc.) the symbiotic relation is usually found between two members of the vegetable kingdom, not between animal and vegetable, as in this case and that of Schizomycetes. It may, therefore, be seen, that the botanist can be of especial value to the pathologist, and particularly so if at the same time he appreciates the true physiological aspects of the question.—Science Gossip.

Fate of the Antilles.

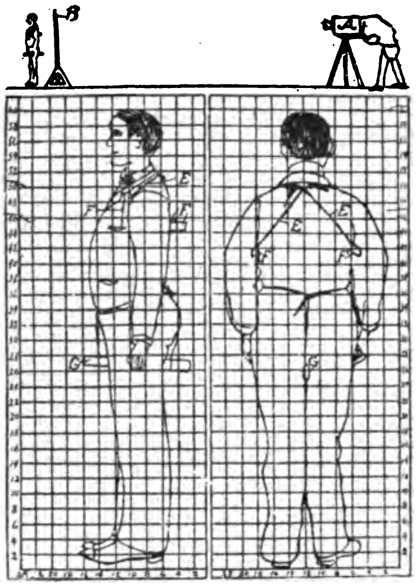
The well-known geologist, Prof. Heilprin, takes a gloomy view of the future that awaits the islands of the Antilles. His forecast, which cannot be lightly dismissed as a mere nightmare of the imagination, is enough to make the most callous shudder. His contention is that the recent disturbances may very possibly result in the complete collapse of the islands. He suggests that the constant eruptions mean that a large hole is being made in the bosom of the earth, and it follows that when it reaches a great size subsidence must follow. It is believed by many that the Gulf of Mexico and the Carribbean Basin were formed in this manner, when the Andean mountains broke down, and that the crust of the earth is extremely weak in that region.

High-Speed Trolleys.

It is now nearly six months since the widely-heralded experiments were made in Germany, on the Berlin-Zossen railway, which were to have developed a speed of 125 to 150 miles an hour, and the fact that no report has been made indicates that the experiments were not promising. The highest speed made was a trifle under 100 miles an hour and this spread the rails so that it was dangerous to continue it. The German roads are not so heavily built as the American, and high speeds would be impracticable unless the whole railroad system were virtually rebuilt. The problem of high electric railroad speeds therefore is not so much one of making the cars run as of making and keeping the roadbed in a condition that will sustain such heavy strains.

Tailors' Measurements by Photography.

A recent patent of Franz Dolezal enables one to be measured for a suit of clothes by photography. Says The Photo-Gazette as quoted in the Literary Digest: The person to be measured is placed before the camera, and between them is introduced a network that is photographed at the same time and serves as a standard.



Certain artifices are necessary to obtain a complete result; thus, certain hidden parts, like the armpits etc., must be indicated by objects visible from without; and, finally, several views must be taken from various standpoints. The subject is also fitted with a sort of harness, which appears in the picture and which indicates points of comparison. These points may, however, be marked directly on the person instead. The relative positions of the camera, the network, and the subject are carefully adjusted so that the subject appears always on the same scale, and then the photograph is taken from the various standpoints.

The Flat Fish Eyes.

Messrs. Cole and Johnstone, of Liverpool, in explaining the asymmetry, follow Traquair, disposing first of the mischievous assumptions that the left eye has passed either through the substance of the head or over the top of the head to reach its definitive position on the right side of the body. "The fact is," they remark, "that the left eye is not on the right side at all. Its presence there is purely illusory. What has happened is that the whole of the cranium in the region of the orbit has rotated on its longitudinal axis to the right side, until the two eyes, instead of occupying a horizontal plane, have assumed a vertical one, and the left eye is dorsal to the right."

Malaria in Japan.

Malarial disorders are rare in Japan because the mountainous structure of the country give natural drainage facilities.

BOOK NOTICES.

In a Tuscan Garden. Anonymous. With eight illustrations reproduced from photographs. Pp. 419 John Lane, New York An interesting volume, the author of which says, "Of the writing and reading of garden books there is, indeed, no end, and in mine it will be seen that I can lay no claim to botanical knowledge and am not even much of a practical gardener, only in fact an out-of-door decorator and colorist." But what is written on the subject is most pleasing and instructive. Taken as a whole, the work with its twelve chapters is full of interest from cover to cover. Whoever the author may be, she is a clever, well-informed woman, who though distinctly English, is enjoying her life in Italy; and her experience there is of great interest and value to others who may have a similar object in view—that of making and enjoying "A Tuscan Garden."

The Book of Vegetables. Vol. VII. Hand Books of Practical Gardening. Edited by Harry Roberts. By George Wythes, V. M. H. Together with chapters on the History and Cooking of Vegetables, by the editor. Pp. 106. John Lane, New York. As a writer on various branches of gardening, Mr. Wythes is well known. This little volume does not enter largely into the subject of gardening in general. As may be judged by the title, merely the vegetables of common use, some twenty in all, are described. The author goes quite deeply into the best methods of the cultivation and selection of different varieties.

Nature Portraits. Studies with Pen and Camera of Our Wild Birds, Animals, Fish and Insects. Text by the editor of "Country Life in America." With fifteen large plates and many illustrations by the best nature photographers. New York: Doubleday, Page & Co. 1902. The great attractiveness of this very beautiful book lies in its illustrations. Fully half of these have been made by Mr. Radclyffe Dugmore, whose success in photographing birds and fish under the most difficult conditions and in the most characteristic positions and occupations, is well known. In the present volume he shows us a live salmon in its native element as it has never before been successfully photographed; a moon-fish with the moonlight effect to which the name is due, conspicuous; a mouse suckling her young, woodchucks, prairie dogs, and a variety of fish, the two most effective examples being the parrot fish and the "pudding wife." One delightful plate bears the legend "A Disreputable Pair," and portrays a couple of owls in attitudes strongly suggestive of inebriety. Mr. W. E. Carlin also contributes some portraits of shy animals obtained at the cost of great pains and ingenuity. An excellent picture of the "Pocket Gopher" was gained by digging sixty-seven feet in the tunnel.

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New England Conservatory of Music.

The most progressive step that has been taken during the school year just closed has been the establishment of a School of Opera, as one of the departments of the Conservatory. The brilliant success of its initial performance in Boston on May 23d attracted widespread and enthusiastic praise that fully justifies the new movement. Boston's musical critics united in commending this choice of wise lines and right goals and declared the occasion full of promise for the musical future of the country.

The Orchestral department has grown steadily under the baton of Director Chadwick, and its importance in ensemble playing with vocal and instrumental soloists, was given convincing demonstration at the recent public exercises of Commencement Day.

In the coming autumn, September 18th, the Conservatory will establish itself in its new home on Huntington Avenue, the most magnificent conservatory building in the world, designed especially for its use The new residences for lady students overlook Boston's famous park system and in their construction and appointments meet the most exacting standards of refined taste and comfort.

The faculty list of the Conservatory has been materially increased by the addition of instructors of international reputation, and all indications point to a new and most successful era for the institution.

◆

Cheapest Branch of Astronomy.

One of the advantages attached to the investigation of meteors is that instruments are of no avail to the student—in fact, meteoric astronomy is the only branch of the science which can dispense with instrumental aid, and, as such, is the cheapest. In this respect it differs from the study of the sun, moon, planets, comets and nebulæ. Without optical aid, observations of these latter bodies will teach the observer virtually nothing. For useful work an expensive and well-equipped observatory is indispensable. Those interested in astronomy who cannot afford such luxuries, however, should consider themselves extremely fortunate in having within their reach the shooting stars, which become visible, and are seen to best advantage with the naked eye.

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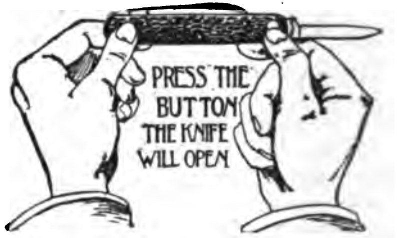

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The Fire-Walk.

The following is an extract from an article headed "In the Australian Back-Blocks," in Blackwood's Magazine: The Australian aboriginal is believed to be the lowest form of humanity extant; but there are many things in his philosophy of which the white man has not dreamt. He fights with nature for his very existence, and even then he is haunted with an eternal dread of devouring demons. His Bora is his only safeguard against these Ghingis and Bunyips; and it is in matters pertaining to the observance of its various corroborrees that he has achieved such triumphs over nature, and performs feats that to the white man are entirely inexplicable.

An ordinary corroborree is merely a meeting that may be summoned by chief or elders of any tribe; but those relating to the Bora are a series of religious ceremonials culminating in a weird fire-test, which all young warriors must undergo before attaining to the state of manhood. This fire-test, with various modifications, is also practised by the New Guineans and South Sea Islanders; but with the latter it now seems to have degenerated into a performance of the priests alone; and in the Fiji Islands a form of fire-walking is still observed, chiefly for the benefit of the sensation-loving tourist. Among the Australian aborigines, however, the working of the Bora is the chief object of their existence, and with them the tests are very real indeed. The fire-test is worked by a procession of aspiring natives marching round on a path which leads through the centre of many fires. A figure in the fanciful attire of some strange monster apparently controls the movements of the warriors by the motion of some object which he swings rapidly round his head, and which produces a humming sound not unlike that of a steam-siren. The performance is followed by a warlike display supposed to strike terror to the heart of the dreaded Bunyip, and if that creature could see, it would speedily take itself off to some less dangerous-looking part of the globe.

A strange substance resembling tea, is Pidcherie —money can't buy it. It comes from the Mullagine swamps, an' gold nor lead would not make a black fellow part with it. Swallow that an' you can dance in the fire an' not feel nothin'; cut yourself in little bits an' you'll think it fun. Only the niggers know what it is.

The Bunyip (this Australian "boggart") is a strange, mysterious creature, half-fish and half-fiend, the very sight of which, it is said, means death to the unfortunate beholder.

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Death from Tight Lacing.

A girl in London a few weeks ago died suddenly while singing at a Salvation Army meeting. The doctors found that death resulted from valvular disease of the heart directly produced by tight lacing.

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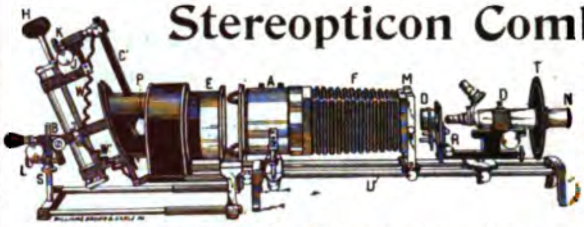

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NATURE - ART - SCIENCE - INDUSTRY

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Tests of Edison Storage Batteries.

Mr. T. A. Edison was seen recently at his laboratory in Orange, N. J., and gave some account of recent tests that have been made, says the Electrical Review, with an automobile equipped with his new form of storage batteries.

The first test, he said, was made on a runabout machine carrying two passengers and equipped with 21 cells. This automobile had a very small battery space in it, and only that number of cells could be accommodated. The complete equipment of batteries, including the electrolyte, weighed 332 pounds. The route selected was in his vicinity, over the ordinary Jersey road, some macadam and some mud, and some sand and some good pavement. In all 75 hills were ascended, ranging from 2% to 12% grades. Some little of the route was level, and, of course, some was down hill.

Mr. W. G. Bee, who took the machine out, travelled 62 miles, and when he brought it back 83% of the original speed could still be had from the batteries. We thought this was pretty good, but later we took the same machine out, with the same batteries, fully charged, on a fairly level road and ran it to a standstill. It travelled 85 miles and stopped when the battery showed only 6·3 volts. The initial pressure from the 21 cells was 29 volts. After running 62 miles up and down hill on the first day's trial, the pressure stood at 22 volts. We are going to put out some big automobiles—five of them—and run them for a 5,000-mile endurance test over the country roads in the vicinity.

The object of making this test is to find out for ourselves what this battery will do. We have not yet been able to notice any depreciation. It seems to make no difference to the cells whether they are discharged slowly or rapidly, and their out put is much the same whether current is taken from them slowly or practically on a short-circuit. One curious effect we have noticed, though, is that the cells seem actually to work better in the automobile than they do on a test in the laboratory. Now, this puzzled us for quite a while, until discovering the explanation, which is very simple. We know the plates are composed of perforated boxes containing the active materials, and when the cell is standing still on the table little bubbles of gas may form behind some of these openings, thus cutting down to some degree the effective material exposed. On the automobile, though, these bubbles are shaken out, and this is the reason why. We have found results on these runs which are even better than we had calculated they would be.

When asked when the battery would be put upon the market commercially, Mr. Edison said: Our factory is now finished, the machinery is all in, and we are making cells, but we are making them as yet for our own tests. If there is anything the matter with this battery, we want to find it out for ourselves and not let the public tell us about it. For this reason I am not going to let a single cell go out of the house until those trial automobiles have run 5,000 miles, and then brought home their batteries in as good shape as when they started.

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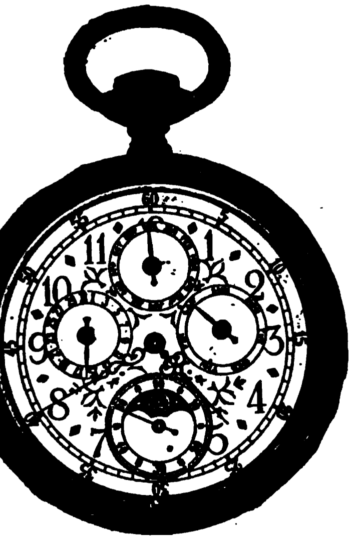

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Thinning Fruits.

The practice of thinning fruit has long been known to the fruit grower in Europe, says E. P. Sandsten, Maryland Agricultural Experiment Station, in bulletin No. 82, and off years in fruit, with them, are almost unknown. In America, where the desire is to produce quantity rather than quality, the practice is generally looked upon with disfavor.

If many fruits are set and are allowed to remain, the energies of the tree are spread out over the larger number, and few, if any, will reach the limit of their possible growth. If, on the other hand, one-half or two-thirds of the young fruits are removed, the remaining ones will have an opportunity to develop to a normal size. Moreover, the vitality of the tree is greatly preserved by such reduction, since it is not the size of the fruit that impairs the vitality of the tree, but the number of seeds, which are allowed to mature. By removing one-half or more of the young fruits, we do not only make it possible for the tree to produce a larger and finer fruit, but we also preserve the vigor and longevity of the tree. Judicious thinning makes it possible in many cases to produce a crop of fruit every year, and still keep the tree in better state of health.

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Third.—Thinning lessens the loss occasioned by rot, and other fungus diseases of the fruit, by eliminating the danger of infection by contact. It also in a measure prevents the appearance and the spread of diseases by permitting better ventilation and drying of the fruit inside of the trees.

Fourth.—Thinning will produce larger fruit.

Fifth.—Thinning will produce a better colored fruit by admitting more sunlight into the tree.

Sixth.—Thinning tends to ripen up the fruit more uniformly.

Seventh.—Thinning will produce a more salable and higher-priced fruit by reason of the increase in size, higher color and general appearance.

Eighth.—Thinning will preserve the shape of the tree and prevents the breaking of overloaded branches.

The Chinese Language.

The Chinese language is ideographic. It conveys the idea and not the word for a thing, as the figure "8" represents the idea and not the word. The Chinese have invented more than 40,000 marks for their writing.

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New Fire Pump in Rouen.

Consul Haynes, of Rouen, reports that an experiment was made at the Hotel de Ville with a new fire pump invented by Mr. Robert Lefebre, captain of the Rouen fire company. This pump is so small that only a very light two-wheeled cart with one horse is necessary to transport it. The dynamo is so constructed as to be run by a current from the street car or electric-light wires, and is brought into contact with them by means of a hooked pole or rod. The pump furnishes a pressure capable of throwing a jet of water, with a force equal to that of a steam pump, to the height of over 100 feet. It also has the advantage of being placed quickly in action wherever there is an electric current. For this operation, it took only three minutes in the experiment, whereas to get a steam pump up to the same pressure takes fourteen minutes.

◆

Gum Arabic Produced by Ants.

Walter Busse, who has been investigating the gum production of German East Africa, states that practically all secretion of gum in that country is provoked by ants. The ants perforate the bark of the acacia to gain admittance into the wood, where they lay their eggs in the excavations which are sometimes of considerable extent. The acacias with soft wood generally show few wounds of this kind; the hardwood acacias are riddled with them, each perforation being marked with a globule of gum. The ant that produces the gum makes no use of it; it is only an obstruction to her work, since it stops up the galleries she hollows out. Another species of ant, however, sometimes attacks the exuded gum before it has become completely hardened, and gives it the peculiar appearance well known to collectors.—Chem. & Drug.

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From life by C. Reid.

THE BEAVER.

About the Beaver's Tail

By ROBERT B. BUCKHAM.

SOMETIMES it would almost seem as though nature occasionally indulged herself in sly humor. For example, after having created the fishes without any necks at all, so demonstrating this portion of an animal at least to be absolutely unnecessary, she turns about and brings forth the giraffe, with a neck longer and more conspicuous than all the rest of his body together, so putting to confusion any who would reduce her to fixed rules and methods.

Or again, having proven in the domesticated variety of the cat that a tail is indeed a thing of beauty and grace, adding materially to the appearance of the animal so fortunate as to possess it, she thereupon decrees that the wildcat shall go through life with nothing but a stub of an appendage that arouses laughter whenever seen, from the ridiculous appearance it gives him, so amusing herself at the expense of this poor and unoffending beast, who goes about, however, in utter ignorance of the ludicrous figure he cuts, like a growing schoolboy in a coat many sizes too small for him.

But perhaps the most ludicrous caudal adjunct which nature has appended to any beast on earth, whether in fun or in all seriousness, is that which the beaver drags about after him; a great, heavy, clumsy, repulsive looking object, in appearance much like a young wife's first attempt at a pancake. The mere thought of having to tug such an affair around through life is enough to make one heartsick. What was nature thinking of when she fashioned it? Was it necessary? Of course not. She herself demonstrated that when she produced the muskrat, or water rat, an animal much like the beaver in every respect, except that it has a respectable and not ungraceful tail. Was it for some particular purpose, or simply for the sheer fun of it? Who can say?

But whatever nature's motive in giving it, its possessor has learned to make good use of it, nevertheless. If every man could put to profit his drawbacks as the beaver does his ungainly tail, all would be able to be of much service in the world. Old hunters and woodsmen, who have had good opportunity to observe him, tell strange tales of what he can do with it. They say that in building his dam, first of all he uses it as a drag. Two or three beavers will pile onto the tail of another a good-sized heap of mud which is to be used in plastering the dam; then when the load is ready he draws it off to the water's brink, dumps it, and returns for another.

When enough plastering mud has thus been gathered for the purpose in hand, the beavers turn in and smear it onto the dam, using their tails for trowels, exactly as a mason would, hardening and smoothit down with many a vigorous slap, and so rendering their barrier waterproof. The writer would not care to say that he believes these statements implicitly, but they are maintained with much ardor by the woodsmen, and they, if anyone, should have good reason for their candor.

In one way, the beaver could turn a college student green with envy. It is said that collegians delight in nothing more than in making their presence known in theatres and other public gatherings by clapping their hands so vigorously whenever applause is appropriate, and sometimes when not, that the result is fairly deafening. But the beaver can clap louder than any college boy who ever saw the inside of a theatre as yet, and he does it with his ugly tail, too.

His powers in this direction he uses as a danger signal. Whenever he suspects the presence of an enemy, he immediately dives, and just as he is in the act of going under, he lifts his great, flat tail, and hits the surface of the water with it a slap that produces a report exactly like the crack of a rifle, enough to startle you out of your boots, if you are not expecting it and looking for it. In this way he gives warning to all his tribe for a mile around that you are at hand, and pretty effectually, too, to say nothing of so throwing you off your guard that he need fear no interference from you, no matter how steady your nerves.

Dissection reveals the fact that the muscles governing the tail of the beaver are so enormously developed, and especially upon its under side, that the blow which can be struck with it, and particularly downward, must be terrific. Anyone who has ever heard his signal of warning near at hand, can well realize this to be so.

But again, still another occasion upon which the beaver can make good use of what would appear to be a useless appendage is when he is in the act of swimming. Ordinarily this animal swims with his hind feet only, which are webbed and strong, folding his fore feet close up against his body, and directing his course, this way or that, with a slight motion of his tail, and thus he makes a swift and capital swimmer. But should the case be one of direst distress, and should he find himself in imminent danger of his life, then he resorts to other tactics. Up and down, like the driving rod of an engine or the arm of a jig-saw, goes his ponderous tail, now become his scull and propeller, and he shoots off before it through the water like an aquatic comet.

From the bank you see two or three strokes of it, just as though it was waved at you in flippant defiance, and then its owner is gone, so rapidly that you could not stop him with a spear, or a stick or stone, or even a bullet, and it is needless for you to look for him farther, since you will not succeed in finding him again.

To such profitable uses as these, with many others, does the beaver put this unattractive gratuity from the hand of nature. And now, when he is so unfortunate as to come into the possession of man, what use does he, in his turn, make of it? Exactly the same that he makes of almost every other object in nature which comes within his grasp, and is susceptible of it; he eats it.

Repulsive and disgusting as an article of diet as a beaver's tail might appear to an individual of fastidious tastes, with its scaly skin and its coarse fat and fishy smell, yet the Indians and thorough-going woodsmen eat it with a relish, and consider it a great delicacy. In fact, the naturalist Cartwright goes so far as to say that when this animal has been feeding upon birch and willow twigs all the season, "its tail is more delicious eating than the flesh of any other animal in the world." But tastes differ in this matter, as in everything else.

Marconi's Latest Feat.

News comes from England that Marconi, while at Cronstadt, Russia, succeeded in receiving wireless signals from the Cornwall station. The distance was about fourteen hundred miles, and the signals were transmitted partly overland and partly over water.

Animal Life

FAMILIAR BIRDS OF PUGET SOUND.

BY CARRIE H. GARRETSON.

Many people who come to reside on the beautiful tree-fringed shores of Puget Sound, complain, among other home-longings, that they miss the birds. It is true, we have but few songsters compared with many parts of the country, and we do miss very much the full, beautiful chorus that greets one upon awakening in the early morning in an Eastern village, and often long for the scent of a fragrant meadow and the joyous melody of the bob-o-link.

But, nevertheless, there are more birds here than most people seem to be aware of—many of them Western varieties of familiar Eastern songsters, darker in color, a trifle larger, and some with a song more varied and sweet. And very likely, when more land is under cultivation and there are fine old shade-trees, the birds will find it out in some mysterious way. For within the past few years the English sparrows have discovered us, though fortunately they are still comparatively few in number. And quite recently the pretty evening grosbeaks (Coccothraustes vespertinus montanus) have begun visiting those parts of town where the maples are old enough to bear seeds, of which these heavy-billed birds are particularly fond.

Robins, bluebirds, wrens, chickadees, song sparrows, snowbirds, towhees, blackbirds, meadow larks, flickers, Steller's jays, crows, and sea gulls are permanent residents in this mild climate. The western robins (Merula migratoria propinqua) are almost the same as the eastern variety, just a trifle darker. In the fall they congregate in large flocks on the outskirts of town, from where small detachments frequently visit the lawns in search of worms or the berries of the mountain ash, all during the winter. They run around in their pert, independent way, and act as if the flickers, which are almost daily visitors, were trespassing as they quietly poke their long bills about in the grass; and openly resent the presence of the Alaska robins, busy tossing the dead leaves about to get the white grubs beneath them. But the robins, like all of our birds in winter, are usually so silent they attract very little attention, though sometimes a particularly friendly one will sit in a favorite tree near the house and sing softly to himself nearly all day, with the drizzling rain for an accompaniment.

The Alaska robins or varied thrushes (Hesperocichla naevia) generally spends but a few weeks with us, returning to their northern home early in the spring, and I believe the bird is rarely seen on the Atlantic coast. They somewhat resemble meadow larks, though their striped backs are darker, and their breasts, below the round black collar, are orange instead of yellow. Rain or shine, Oregon snowbirds (Junco hymealis oregonus) are always to be seen in the willows and low bushes of vacant lots, or about the house looking for crumbs—numerous small flocks from fall until spring, and the old birds with their young in summer. Their jet-black heads and throats are prettily set off by their flesh-colored bills and soft grey breasts, and they have a very coquettish way of opening and shutting their tail feathers to display the white quills, particularly during the mating season

The rain does not dampen the spirits of the bluebirds either, as it does the song sparrows' and many others, but they always disappear for a few days if the weather is unusually cold, and their sweet, plaintive notes are not heard again until it is warmer. The male western bluebird (Sialia mexicana occidentalis) is decidedly darker than the eastern variety, though his mate is a delicate grey washed with blue, and the young birds are almost as brown and speckled as sparrows. Another dark species is Stellar's jay (Cyanocitta stelleri) which takes the place of the common blue-jay in this region. You hardly know the bird at the first glance. He is so dark as to look black in the shadow of the forest, but when he flies into the sunlight the brilliant blue of his wings and tail, marked with the familiar bars, and his beautiful crest call forth an exclamation of delight, as you recognize the handsome bird. These jays are more dignified than their eastern relatives, and very shy, seldom coming near the house, but seeming to prefer the tops of tall trees on the edge of the woods. In winter, however, one is frequently seen on the ground scratching among the dead leaves, in the company of smaller birds, particularly song sparrows, and apparently on the best of terms with them. But I fear he is treacherous and his friendship only feigned in order to learn their secrets, as his ways in summer are very suspicious

The gray jay (Perisoreus obscurus griseus), a western representative of the Canada jay, that frequents the mining and logging camps, is only occasionally seen in the town. The first time I heard the cry of the Oregon towhee (Pipilo maculatus oregonus) I was delighted, thinking it was another old friend, for its call, unlike the eastern chewinks, resembles the mewing of the catbird. A search, however, revealed, not the dark grey mimic, but a pair of spotted towhees and a plump brown bird with a streaked breast and yellow bill, whose only resemblance to its anxious and excited parents was the four white thumb marks on the under-side of its long tail.

The towhees are shy, lonely birds, always found in pairs that skulk about beneath the brakes and salal berry bushes, calling dismally to each other if by any chance they are separated, unless the female is nesting. Then her mate will sit on the top branch of a bush or shrub and sing his love-song, which is only a heavy, though not unmusical, trill.

Snow is so unusual it causes great consternation among our birds. If the ground is covered in the morning they fly about distractedly, uttering the most disconsolate chirps. A handful of crumbs and seeds will soon attract the song sparrows, juncoes and towhees; while the mountain ash will be filled with the pretty purple finches and their little streaked mates, robins, flickers and Alaska robins. They are all so hungry and quarrelsome that the tree is soon stripped of its bright berries, many of which are crushed and dropped on the snow where the other birds are quarreling over the crumbs; and more than once various feathers have been left as mementoes of the affray.

One winter, when the snow lay about two feet deep for nearly a week, one of the California mountain quail (Oreortyx pictus), which in these northern latitudes descend to the sea-level, became so bold from hunger, that he too came regularly to the foot of the steps for his share of the wheat thrown out. He was a pretty creature, larger than the eastern "Bob-white," with a bluish slate-colored breast, cinnamon and white sides, and on his bluish head two long, drooping, black plumes, that stood erect when the bird was excited. The day before the thaw the quail brought four of the flock with him, and after much pretty coaxing succeeded in alluring two of them on to the lawn and the others nearly across the street, when some pedestrians frightened them all away.

After the meadow larks (Sturnella magna neglecta) sing snatches of their songs in the early autumn, they become perfectly silent, and their striped backs so blend with the dried grasses and weeds of the roadside that they are almost invisible. In January they usually begin to sing, and how beautiful the bird looks with the sun shining on his yellow breast and black collar, as he sits on the very top spray of the glistening madrona! His is the first note of spring, and as you watch him and listen to the clear, sweet song, all the world seems bright and joyful, and you forget the gloom of winter.

By March they have paired, and when the male pauses after every burst of melody his mate will answer him with a trill from somewhere in the grass. Then he will sometimes fly up in the air singing an excited jumble of notes, as if too happy to express himself.

(*To be continued.*)

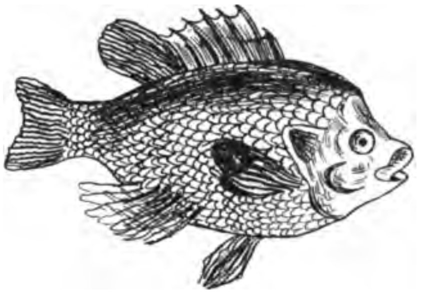
Color Changing Paint.

To indicate when the moving parts of the machinery have become excessively heated, a German inventor has devised a paint composed of an amalgam of the iodides of mercury and copper, which the inventor claims will change color when heated.

QUEER NESTS.

BY LIZZIE M. HADLEY.

Where do you suppose they are? Not in the trees and shrubs or even in the tall grass, where you might expect to find them, but of all places in the world, snugly tucked away in some sheltered spot in the water, and now, of course, you will guess that the little owners are only fishes.



SUN-FISH

I think most of us have always been inclined to look upon these members of the animal kingdom as rather stupid things, whose only excuse for being is to furnish a variety of food for our tables, but these little nest builders prove that we are mistaken in this belief, since they exercise full as much skill and ingenuity in constructing their nests as do their "little brothers of the air."

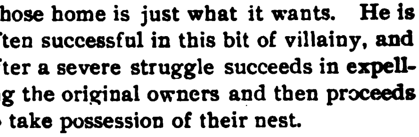
One of the commonest of them is the sun fish, of which there are as many as twenty-five different species inhabitating the rivers and ponds east of the Rocky mountains. According to some authorities they receive the name of sun-fish from their habit of basking in the sun, while others ascribe it to their brilliant colors. Their family name is Pomotis, but in addition to the name sun-fish they masquerade under various pseudonyms, and according to locality are known as pumkin-seed, copper-nose, bream, tobacco-box, pond perch and sunny. They are evidently greedy little fellows, real "Oliver Twists" of the water, who are constantly on the lookout for "more" flies, worms, bugs, and other fishy tid-bits, and only too often, to the disgust of the angler, take the bait prepared for better game.

They go in pairs, and as the breeding season approaches may usually be found among the lily roots and other water plants, searching for a nesting place. They look for some sheltered spot not far from shore, and when they have found a desirable site they immediately begin work upon it. Their first care is to free the soil for a number of inches from all roots and plant stems, and these are carried quite a distance, often several feet, no small undertaking for little creatures who have only mouths to take the place of hands.

When this work is accomplished to their satisfaction they take away all the bits of roots, stems, etc., that may have fallen near, and how do you suppose this is done? By their mouths? No, indeed! But by means of their tails, which really make very good brooms, and they use them quite skillfully, agitating the water in such a way that they create a sort of whirlpool which carries off all the refuse. This disposed of, they next proceed to take away the stones and pebbles, and this is done by pushing and sweeping, or carrying them in their mouths. They continue this work until they have hollowed out a veritable little nest with a nice sandy bottom, and here the eggs are deposited.

Many nests are usually found in close proximity to each other, but this may possibly be as much for safety as sociability, since man is by no means the only foe they must guard against. In the single state they seem to be playful and peaceable little fellows, but let a pair once "set up housekeeping," and woe to the luckless intruder who dares venture into their neighborhood. They fairly bristle with rage at the liberty, and are ready to fight the whole aquatic world if their homes are threatened, and not one pair alone, but the whole community will make common cause against an enemy, charging with the greatest fury and using their tails with such vigor that they frequently rout the largest fishes. But, unfortunately, there is one enemy they are not always able to vanquish, and that is the pirate perch.

This fish is evidently a good deal of a savage and prefers fighting for a home to working for one, since, although, like other fishes, it likes a safe place in which to deposit eggs, it seldom, perhaps never, builds a nest of its own, but depends upon superior strength to despoil the sunfish, whose home is just what it wants. He is often successful in this bit of villainy, and after a severe struggle succeeds in expelling the original owners and then proceeds to take possession of their nest.



LAMPREY EEL.

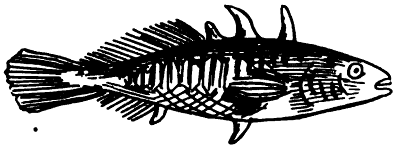
Yet, apparently, he has no especial antipathy to the sunfish, as a fish, since having obtained what he needs—a home for his prospective family—he allows the eggs already deposited in the nest to remain there and guards them as jealously as he does his own, and even cares for the young sunfish until they are able to begin life for themselves.

The lamprey eel is another of the nest builders. He is found in both fresh and salt water, and differs from the common eel in having a sucking mouth and seven holes on each side of the neck, in place of gills. These fish go in pairs, and like the sunfish, before beginning to build, clear a considerable space from roots, stems and water grasses. But there the resemblance ceases, for when this is done, instead of hollowing out a nest in the sand, they proceed to cover the place with pebbles and stones, some weighing several pounds. These they move by means of their suctorial mouths which give them the power to adhere firmly to any rock, and both may often be seen pulling, pushing and dragging one of these large stones into its place. Layer after layer is added until the pile reaches one or two feet in height, and perhaps three or four in diameter.

The eggs are laid in the crevices of this pile, which thus becomes a sort of stronghold where the young ones may be safe from harm. This is needed, probably for some time, since until they are about six inches in length they have neither eyes nor teeth and merely a long longitudinal slit for a mouth.

The sticklebacks, of whom there are some twenty different species, also belong to the nest building fraternity. These fish make their homes not far from the mouth of some brook or river and, excepting at the breeding season, go in shoals and are often taken for their oil which is of considerable value. They are noted for their elaborately constructed nests, which are sometimes placed in the refuse at the bottom of the stream, but are oftener pendant from some jutting rock or the submerged branch of an overhanging tree, where they swing back and forth with the motion of the water like veritable cradles in which to lull the baby sticklebacks to sleep. These nests are made of roots, grasses, leaves, stems, etc., wound round and round with a kind of viscid, silky thread, which holds them firmly in place.

NEST OF LAMPREY EEL.



STICKLEBACK.

The male stickleback does all the work, and, probably with an eye for his own comfort and convenience, has openings on opposite sides of the nest, so that he can swim in at one door and see what is going on inside, and then, without turning, can swim out at the opposite one. When the nest is completed he seeks the female stickleback and, apparently, after considerable coaxing, persuades her to enter it.

NEST OF STICKLEBACK.

But she is either fickle or dissatisfied with her surroundings, for after depositing a comparatively small number of eggs, she goes out of the opposite door and swims away, leaving them to their fate. The male appears to take this philosophically and immediately proceeds to look for her successor, and presently Mrs. Stickleback number two is installed as mistress of the nest, but only too soon she follows the example of her predecessor. Yet, nothing daunted, the male again goes a wooing, and never seems discouraged although numbers three, four, five and six only stop long enough to deposit a few eggs. But after the defection of number six, he evidently thinks there are eggs enough in the nest to make a pretty good-sized family, and he no longer concerns himself with the female portion of the community, but devotes his time and energies to caring for the nest and its occupants.

The dace, catfish and scores of others in both temperate and tropical waters are also nest builders, and well worth a careful study, since they show wonderful instinct or wisdom in adapting themselve to their environment. But most of them are exceedingly shy, and the nests are so cunningly concealed that it requires a trained eye to discover them.

Black and Green Tea

One of the scientists at the Agricultural College at Tokio has been investigating the subject of the difference in the color of tea leaves, and he offers the following explanation; in making green tea the leaves are steamed as soon as they are gathered; in the case of black tea the leaves are allowed to ferment before drying. The result is that the finished black tea contains much less tannin than the green. The original tea leaf possesses an oxidizing enzyme, which is destroyed in the green tea by steaming. In black tea, during fermentation, the enzyme oxidizes the tannin, and gives a brownish product.

Plant Life

THE LEGUMINOSÆ AS FERTILIZERS.

BY "NATURALIST."

Agriculturists have long known that clover, peas, beans and other Leguminosæ, have the power of enriching poor soil and fitting it for the production of cereals; but it is only within recent years that various investigators, like Woronin, Frank, Moeller, and especially Hiltner, have discovered the true explanation for this remarkable power.

The roots of leguminous plants, particularly those growing on sterile ground, are found to be covered with numerous roundish, white bodies called root tubercles. If we start a young seedling of a pea or clover plant in soil rich, but sterilized, no development of these tubercles is found to take place, and at the same time it is observed that the plant does not thrive as it would in unsterilized soil. This proves conclusively that the swellings on the roots must be caused by some organism existing in the soil, and that whatever this organism may be, it is of benefit to the plant.

On cutting open one of the root tubercles and examining a small portion under the microscope, we see a large number of rod shaped and y shaped masses. These masses are low fungi or bacteria, and are usually referred to by the term "bacteroids." Bacteroids are, then, the organisms which cause the formation of the root tubercles, and are undoubtedly of advantage to their host plants.

Bacillus radicola, as the bacteroid occurring among the Leguminosæ is specifically termed, enters the root hair from the soil in the form of a mucilaginous thread. When this thread reaches the root proper, it penetrates one cell after another, and thus stimulates the root to greater activity, the result being the formation of a tubercle. The filaments of the fungus then undergo repeated branchings inside the tubercle, and fill many of its cells. At certain points along the threads enlargements appear, and by the breaking up of the threads countless bacteroids are thus formed.

Leguminosæ which have developed tubercles contain more nitrogen than it would be possible for them to have obtained from the nitrates of the soil in which they grow. Thus it is clear why plants having tubercles thrive so well in soil which is poor in nitrogenous plant food.

The existence of a fungus or bacterial organism in the root of a higher plant furnishes an example of the so-called "Symbiosis," both individuals gaining an advantage by thus living together. The assimilating green plant supplies the bacterial organism with carbohydrates, while the latter furnishes, in return, nitrogen in an available form. The leguminous plant also absorbs many of the bacteroids rich in proteids; while late in the season, some of the tubercles die, and thus enrich the soil with nitrogenous substances, increasing its fertility and fitting it for the support of subsequent crops.

Several other plants, such as the Alder and certain members of the Elæagnaceæ, have root tubercles with a similar function. In the case of the Alder the bacterial organism is able to function fully under water, while the form occuring among the Leguminosæ cannot do so.

It is an interesting fact that the early crop of a plant like the Wax bean posseses much larger root tubercles than a following crop of the same plant growing in the same soil and passing through its first stages in midsummer. This rather unexpected phenomenon is explained by the fact that during the warm weather of summer, the bacteria in the soil are very active, and supply the plant with an abundance of nitrogen. In early spring, however, they are much less active, for which reason the host plant is very "nitrogen hungry," and develops an abundance of large root tubercles in an effort to obtain the coveted supply of nitrogenous matter furnished by the bacterial guests.

In conclusion it may be stated that the remarkable discovery of the fertilizing power of certain bacteria is likely in the near future to be of great economic importance to scientific agriculture.

LOCALIZED STAGES IN TWO COMMON PLANTS.

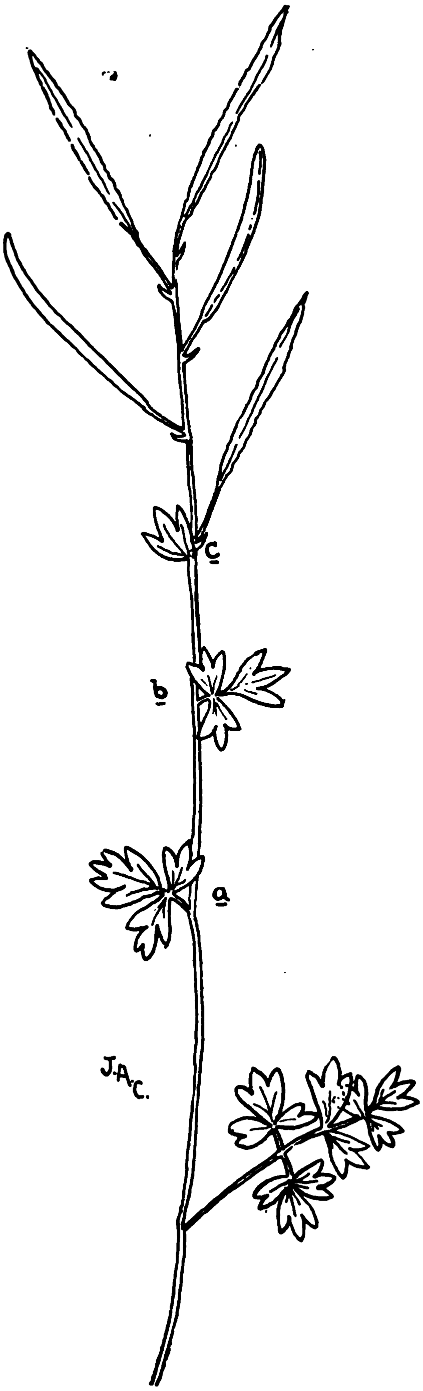
BY JOSEPH A. CUSHMAN.

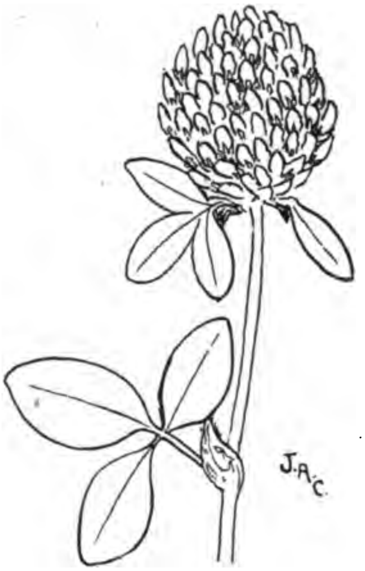
By localized stages are meant stages in certain adult parts which are comparable to those passed through in the straight development of the plant in its growth from the seed. In the leaves this is especially well shown. The first case is that of our Pale Corydalis (Corydalis glauca). Here there is a definite arrangement of the leaves below the flower. The typical species leaf is considerably cut and lobed, being really biternatisect. Passing from these typical leaves toward the flower is found a leaf which fails to develop the full characters. Such a leaf is seen at *a*. Above this leaf is one *b*, simply ternatisect and comparable to the lower leaf figured with the whole of the base removed. Above this is a simple rotund, trifid leaf *c*, and is the last below the flower. This is exactly like the terminal segment of each of the other leaves figured.

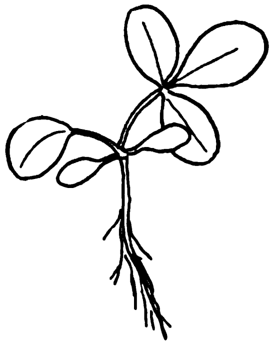
Now comparing this with the seedling in its straight development, a striking similarity is at once noticed. The seedling figured is copied from Lubbock's "Seedlings" '92, and is of a species close to the one dealt with here. The first leaf is like *b* in its essential characters and its terminal segment exactly comparable to *c*. After these leaves figured the plant takes on its typical form of leaf by stages similar to those figured below the flower.

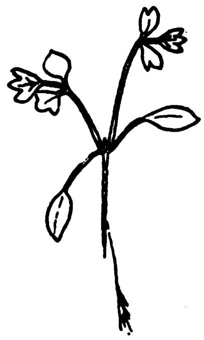
In comparing the two sets of stages, they will be seen to be developed in exactly the reverse order; the first stage in the seedling being comparable to the last stage of the adult flowering plant. By raising a large number of seedlings, as has been done in the case of other similar plants, a few would probably be found which were less accelerated in their individual development, and had for their first leaf a simple trifid one, and the second like the typical first leaf. Leaf *c* below the flower represents that stage in the adult. As will be seen by comparison and has been shown before, the tip of the leaf, which is the first part developed, repeats the seedling characteristic of a terminal trifid leaf.

In our common Red Clover (Trifolium pratense), this same principle is well illustrated. Below the large heads there is almost invariably a trifoliolate leaf and just above this one a simple leaf. Now—if it be one flowered—this simple leaf is the only one in the whole adult plant, and is directly comparable to the only simple leaf seen in the development of the plant up to the time of flowering—the first leaf of the seedling. The first leaf developed in the seedling after the cotyledons is a simple one as shown in the figure. The last leaf below the flower is a simple one. The latter is preceded by a trifoliate leaf and the former is followed by one of three parts. They thus occur in reverse order as in the plant described in the first part,









and illustrate excellently and much more simply, the principle given.

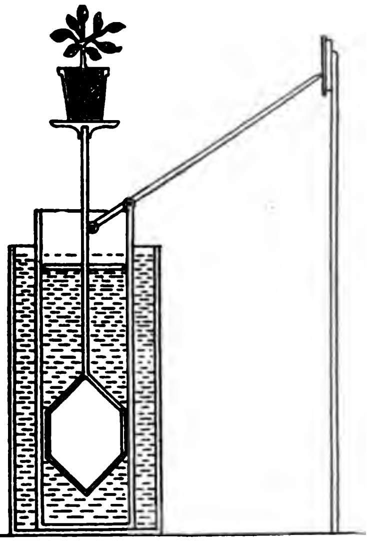
The reason for these simple leaves seems to be that the strength of the plant at that period goes more and more toward the forming of the flower and seed, and thus the plant fails to develop the full characters of the typical leaf.

◆

TESTING ARID LAND PLANTS.

BY CRITTENDEN MARRIOTT.

Few people know how many ingenious devices are continually being invented to meet the especial needs of workers in all fields—devices that are seldom used outside the places where they are contrived, despite their availability for extended use. Among the most prolific in these things are the scientific laboratories of the government in Washington.



An instance has just occurred in the horticultural section of the Agricultural Department, where it was desired to contrive some apparatus whereby it could be speedily ascertained whether or not a particular plant would probably prove adapted to growing under arid land conditions, without going through the long process of actual field trials. Since plants absorb water through their roots and evaporate it through their leaves, it follows, other things being equal, that the measure of this evaporation is inversely as their availability for growth in dry climates. Very slow evaporators will probably do well there, and very fast evaporators will certainly fail. The cacti, for instance, are extremely juicy, but their thick skins prevent fluid almost altogether from evaporating, thus fitting them for the most arid conditions. The question, therefore, was to devise something that would quickly measure the amount of evaporation of any given plant. Difficult as the problem seemed, it was soon solved by Mr. L. C. Corbett, horticulturist of the department. Like most other devices originated by government officials, this was not patented, but was given freely to the world.

The apparatus used is simple. The figure will explain its main features. It consists of two cylindrical cans, one inside the other, with a water jacket between, to keep the temperature uniform. The inner can is also partly filled with water, on which rests a float, through which a slender rod runs freely. Above the water this rod supports a rest on which is placed a pot or tub containing the plant in question. Below, it terminates in an air chamber. A lever arm extends from some place on it to far outside, where is placed a tablet on which any motion it may make is traced by a pencil. The float and water in the cylinder are covered with oil to prevent evaporation. The flower pot or tub is also carefully covered, for the same reason, leaving nothing but the plant itself exposed to the air. As this evaporates its moisture through its stem and leaves, it necessarily grows lighter, and the air chamber below forces it to rise higher above the water. This depresses the point of the lever. The actual vertical movement is of course small, but it can be multiplied to any extent desired simply by lengthening the lever arm.

The diameter of the rod being known, a simple calculation gives the amount evaporated by the plant in 24 hours. Comparative tests show which plants evaporate the least, thus enabling one essential for life in arid climes to be determined in a very short time. The importance of this appears when it is added that some valuable but most unpromising looking plants from other localities have been found to do very well indeed on arid land. Doubtless, more will soon be found, now that an easy and cheap means for a preliminary test has been devised.

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The American Botanical Club.

This has recently been organized for the purpose of studying plants, not names, and members are urged to endeavor to discover new facts about even the most common species. To plant lovers who are making an herbarium or who are engaged in cultivating the wild flowers, the club offers opportunities for securing new, rare or otherwise interesting plants. Mr. Willard N. Clute, the well-known authority on ferns, is president. Every person interested in any phase of botany is invited to become a member of the club. The membership already extends over a large part of North America, and is increasingly rapidly.

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Air Testing

In order to determine the condition of New York City's air, Street Cleaning Commissioner Woodbury has exposed gelatine plates to collect germs. After the first exposure the plates were found to contain such a mass of microbes, as to interfere with microscopical examination, and it was found necessary to expose other plates for a much shorter time, in order to proceed with the work.

Archaeology

Edited by WARREN K. MOOREHEAD, M. A.

THOMAS WILSON, LL.D.

BY WARREN K. MOOREHEAD.

[Read at the Pittsburg Meeting of the American Association for the Advancement of Science.]

Dr. Thomas Wilson was born July 18th, 1832, in Beaver County, Pennsylvania. He was a self-made man. As a boy he was apprenticed to David Woodruff, of Salem, Ohio, who conducted a carriage shop. Attaining his majority, he located in Marshall County, Iowa, and engaged in making heavy plows, used for breaking the new prairie land.

He was chosen a deputy clerk of the court, and this position, small though it was, opened his eyes to the possibilities of a legal career, and he engaged in the study of law during evenings after his hard day's labor over the plows. He was admitted to the bar and practiced with success.

At the beginning of the Civil war, he enlisted in the Second Iowa Cavalry, rose to the rank of captain, but left that branch of service for the infantry. He served until the fall of 1864, when he was honorably discharged with the rank of colonel; gained by distinguished gallantry in action.

He formed a legal partnership with the famous Thomas Corwin, of Ohio, and was instrumental in putting some worthy war claims through Congress. In 1881, he retired from active practice and was appointed consul to Ghent. His consular duties extended over a number of years and he represented the United States at Nantes and Nice. His tact, discretion and natural abilities won for him the commendation of his government.

As a boy, Dr. Wilson had observed the mounds, earthworks and other prehistoric remains of western Pennsylvania. While in France he had opportunity to study the ancient monuments of western Europe, and he made himself an authority. Himself a French scholar, he became familiar with the French School of Anthropology, and when he came to the United States and accepted the curatorship of the Department of Anthropology, Smithsonian Institution, he was fitted to pursue the intelligent study of prehistoric man in this country. His training in law, in the diplomatic service and in European archæology broadened his mind and enabled him to weigh carefully archæologic problems.

Dr. Wilson was one of the few anthropologists in this country confining themselves, almost exclusively, to prehistoric art. I have frequently heard him say that anthropologists were emphasizing modern tribes and modern conditions at expense of the prehistoric. He, himself, was not interested in the modern savage, although he did not deny the importance of such study. Several of the problems, he maintained, relating to man in the United States, could not be solved by comparisons with or a study of historic tribes. After all the traditions, the ceremonies, etc., of existing tribes had been investigated, he thought that there would be a reaction and anthropologists would return to a consideration of the truly prehistoric.

DR. THOMAS WILSON.

I once heard Dr. Wilson call the attention of a visiting ethnologist to the thousand of "unknown" stone objects in the Smithsonian collections. Said he: "They (the ethnologists), publish hundreds of pages giving the minutest details regarding the ceremonies of living Pueblo and Plain tribes. A feather with a notch on the right side has a certain meaning, on the left another, two notches convey a different meaning, and daubs of paint on the tip or on either side yet other meanings. Thus, a single feather may stand for fifty interpretations. If so frail and unimportant a thing as a feather engages our attention, what shall we say of these imperishable stone objects of fantastic and wonderful forms, wrought with patient skill and highly polished? Do not they merit our study?'

Dr. Wilson was prominent in the various expositions held here and abroad during the past fifteen years. He was decorated by the Spanish Government and by the King of Belgium. He served as vice-president in this section His honors were many and varied. The following are some of his reports and publications:

"A Study of Prehistoric Anthropology" (1888), "Results of an Inquiry as to the Existence of Man in North America During the Paleolitheic Period of the Stone Age" (1888), "Criminal Anthropology" (1890), "Primitive Industry" (1892), "Minute Stone Implements from India" (1892), "The Swastika, the Earliest Known Symbol" (1895), "Prehistoric Art, or the Origin of Art as Manifested in the Works of Prehistoric Man" (1897) and "Arrow Points, Spear Heads and Knives of Prehistoric Time" (1898), all of which have been contributed to the publications of the United States National Museum.

Dr. Wilson was possessed of a pleasing personality and a fund of humor. He was not cold and distant as are so many men of science. He was unpretentious. He could rebuke affrontery and ignorance. I crave pardon for relating a personal incident illustrative of his humor.

A very pompous individual came into the exhibition hall one day, and as the doctor was busy, I was instructed to explain the collections. He was typical of a certain class of persons such as render the life of a museum curator miserable. We had been looking in the cases not more than ten minutes, when the visitor announced in loud tones that he had a large archæological collection of his own, and that he knew all about such things, and that if the Smithsonian men knew no more regarding prehistoric times then was evinced by the labels, he would be glad to instruct them.

The door of the office was open and Dr. Wilson, having heard the remark, came out at once. Walking up to the collector, he laid a paternal hand on his shoulder, and said: "My dear sir, if you know all about these things, you are the very man we want. I have studied them all my life and know almost nothing. Come over to Prof. Langley's office and I shall at once resign in your favor."

Dr. Wilson's papers on the Swastika, Stone Art and Arrow-points, have been in general demand and were favorably reviewed here and abroad. His classification of flint implements can hardly be improved upon and must stand. He insisted upon an archæologic nomenclature.

I am convinced that his published observations, save in a few instances, cannot be controverted—that is, so far as they relate to the strictly prehistoric. In his mind to classify the objects left by the Plains tribes of the past hundred years with those from the truly pre-Columbian sites of the Ohio Valley, was an error, "Yet," said he to me, "when I offer a few remarks apropos of some village site of unquestioned antiquity, some champion of the modern origin of all aboriginal remains gets upon his feet and draws a parallel between my site and the modern pueblo or gun-armed, buffalo-hunting tribes of the Plains."

It was this lack of appreciation between tribes of one region and another which he regretted. He believed that the mound-building peoples of the Ohio Valley had nothing in common with the Plains or Pueblo peoples; that a comparison of their pipes, ornaments, etc., was simply out of the question.

He had his own views regarding folk-lore and its relation to the prehistoric. I recall one conversation of some years ago along these lines. I shall not give this as a direct quotation, for although the substance is clear, I do not remember the exact language.

Said he: How is it that the Sioux give elaborate traditions concerning their origin and other mythical matters, yet cannot recall the visits of Hennepin and other early Jesuits? One would suppose that paintings exhibiting the damnation of the wicked in vivid colors, such as the priests carried, would make a lasting impression upon aboriginal minds. They had never seen such mysterious things. And among the more southern tribes the appearance of men in armor, riding horses, would be remembered in their folklore. Yet I fail to find more than a trace of the presence of the Spanish adventurers in southern plains folklore, and a very faint trace at that.

He was wont to tell, with relish, the story common on a certain reservation concerning the enthusiastic young folk-lorist who gravely set down all that the story tellers told him, and that the narrators of the tribe, mindful of the loaves and fishes which he distributed with a lavish hand, got an educated Indian to write him that they had thought up a "lot more yarns" and were anxious to have him come and record them.

Dr. Wilson's interest was not confined to anthropology alone. He was well posted on art and was a numismatist of rank. He did some literary work and published a creditable book on "Blue Beard," etc. He was a contributor to POPULAR SCIENCE NEWS, and readers have perused his lines with profit and pleasure. Socially, his house occupied a high position in Washington and distinguished men and women were wont to attend the receptions held there.

Dr. Wilson was appointed Curator of Anthropology, Smithsonian Institution, in 1887. This position he held up to the time of his death, May 4th, 1902. His administration of the department was more than successful; large donations and additions by purchase were made and the entire collection rearranged and systematized. This latter required much of his time for several years.

Before concluding, permit me to quote a portion of Dr. Mason's eulogy.

"And now another comrade has passed out of the world of sense into the world of memory.* Recall his stalwart form, his strong face, his pleading voice, his air, his spirit. If any question whatever concerning his science were now to arise, it would not be difficult to guess the side on which he would array himself. And there are as many memories as there are relations in life. Since each stands to each at varying distances and in different light, the individual recollections concerning our friend will be infinitely varied in color and tone. They are like a collection of portraits or photographs of the same person in different dress and at various periods of his life.

"Dr. Wilson was easily the best-informed man in our Society on prehistoric and protohistoric Europe, from the rude flints of Thenay, in Loir et Cher, to the relics of Waben, in Pas de Calais, from the Eolithic period to the Merovingian; in the Age of Stone, of Bronze, and of Iron; in Tertiary, Quaternary, and recent times. He knew the vocabulary of technic in each one, and it was delightful to hear him talk about "*le coup de poing*," "*les pointes a main*," and "*racloirs*," about "*pointes en feuille de laurier*," "*burins en silex*," and the rest. He would have been more than human if this foreign training had not dominated and guided all his subsequent opinions and utterances. And so he was, in company with eminent colleagues in both hemispheres, convinced that, but for our ignorance, we should be able, in the western world, to look back over the perspective of human history from the crowning elevation of the twentieth century to the first monument or relics of humanity.

"I should be unfaithful to my duty if I did not extend on my own behalf and for this Society our sympathies to Mrs. Wilson, who was the sharer of all her husband's labors and enthusiasm.

"Into the outer court of private memories Dr. Wilson has passed, he has ascended the steps of the inner court of civic memories, as man of affairs, patron of art and charity, diplomat and soldier; in the holy place of family life are kept burning the recollections of husband, father, brother; and with bared feet he has stood alone in the holy of holies, as you and I must stand, to make an offering of his life work to the court of last human appeal, the judgment and conscience of organized and trained historic science."

In his death I lost a dear and personal friend. Students of American archæology will do well to emulate his virtues, his character, his kindly and gentlemanly bearing and his scholarly attainments. His widow and his son have the sympathy of all who knew and loved Dr. Thomas Wilson.

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Ancient Sepulchre Unearthed.

A remarkable discovery has been reported on the shores of Prince William Sound. While a prospector named Leeds was out with a party of natives looking for mineral, he came to the entrance of a large cave almost concealed from view.

Leeds entered the cavern and was astonished to find there fourteen wooden canoes, each containing a mummified corpse. Stone implements were found beside the bodies and stone slabs covered the canoes, everything indicating that the bodies had been placed there during the stone age.

The find was as big a mystery to the natives as to the white man. Their tribe has been on the shores of Prince William Sound from a period so remote that their traditions do not run back to the time of its advent there, yet they have had no knowledge of the cave or of the character of people who are interred there. Nor do the present natives use stone implements.

◆

Average Life of Man.

Statistics of life insurance people show that in the last twenty-five years the average of man's life has increased 5 per cent. or two whole years from 41·9 to 43 9.

ABORIGINAL REMAINS IN LOWER MOHAWK VALLEY.

BY PERCY M. VAN EPPS.

III.

At the extreme eastern end of the Triangular Flat, a little distance from the mouth of the Verf Kill and where the bending river meets the gravel terrace, have been found unmistakable evidence of a permanent living-place or lodge-site. The dark colored earth, burnt stones, bones of wild animals and potshards, unite to tell the story of former occupation. These objects are found at the foot of the first terrace on ground a few feet higher than the general level of the Flat, just high enough to escape the spring floods, which in the early days, when the river's watershed was yet completely forest clad, probably never rose to the alarming and destructive heights reached in recent years.

From the very limited area over which the pottery is found it appears certain that here was no village of any extent, probably but a single lodge dwelling or wigwam, unless indeed the occupied ground included the terrace just above, whose surface is now completely occupied by the four tracks of the New York Central Railroad.

No finds of bone tools, awls, needles, etc., have been made. The soil having been so long under cultivation, such implements would naturally have disappeared. A few animal bones and teeth have been noticed, but such are in a much decayed and fragmentary condition, but in the almost imperishable potshards we have direct evidence of Indian occupation. The peculiar style of ornamentation impressed upon these fragments tells us that the occupants were Mohawks, and we may safely infer that they were pioneers or settlers from the great Mohawk village on the Cayadutta. We can also fix an approximate date for the occupancy of this site with a reasonable assurance of certainty. This we are the better able to do by reason of the utter absence of any traders wares.

Indian village or "castle" sites of later or colonial times along the middle and upper Mohawk valley furnish, in addition to the common implements of stone and bone, many objects procured from the early settlers or traders, such as venetian beads, iron axes, bullets, fragments of glass, scraps of sheet brass or copper, bits of rust eaten iron and an occasional coin or jesuitical medal. In the exploration of the Triangular Flat not the slightest trace of anything of this nature has been disclosed, consequently we can say with absolute certainty that the site was abandoned before the advent of the Dutch in the valley, about 1620.

In 1535, Jacques Cartier visited the Mohawks at their ancient home on the St. Lawrence. The two towns of Stadaconnè and Hochelaga were ruled by the great chieftain-king Nonnacona. It was probably not many years after this visit that the Mohawks were utterly whipped and routed by some northern or Algonquin foes. The remnant fleeing southward traversed the dark-shadowed eastern border of the great Adirondack wilderness, and finally found shelter in secluded glens opening on the river which now bears their name. Three of these ancient pre-Colonial village sites, veritable places of refuge, are well known to the archæologists of the valley. Thus hidden and sheltered from their implacable northern foes they remained for perhaps half a century or until they again became a strong nation with many young and lusty warriors.

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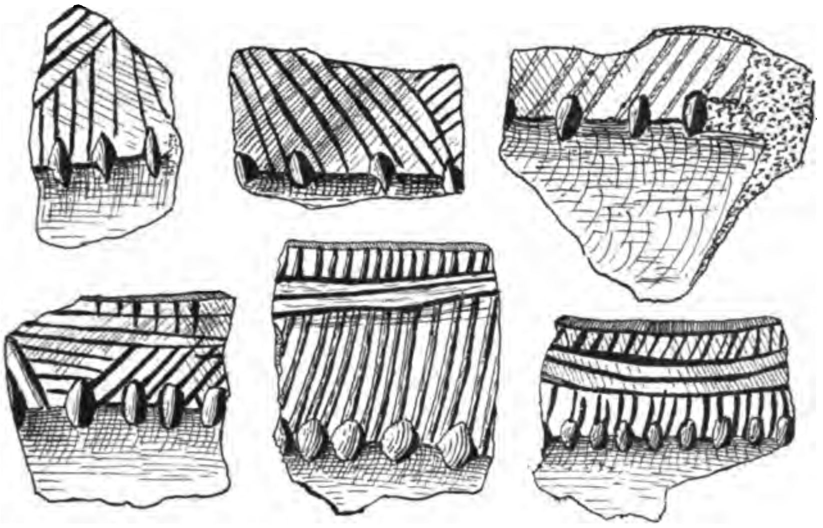
*Presented by Dr. Otis T. Mason at a meeting of the Anthropological Society of Washington, May 20, 1902.



MOHAWK POTTERY WITH CHARACTERISTIC NOTCHED ANGLE.

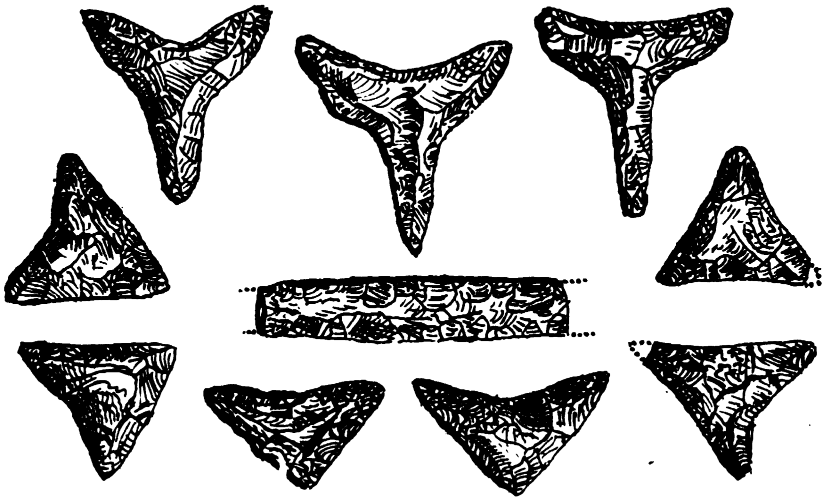
Upper three examples from the Triangular Flat. Lower three from ancient Mohawk village, Cayadutta.

Probably the little pioneer home at the Triangular Flat was of a period just before the time when, as ably told by S. L. Frey in his instructive monograph "The Mohawks" (page 20), "the Dutch were seating themselves securely all along the Hudson and the French were colonizing Canada, and the Mohawks, having grown strong, and long residence havnig weakened their old palisaded towns, and caused a scarcity of fuel, then they came out of their prehistoric seclusion and boldly built their villages immediate on the banks of the river."

Cayadutta, the most eastern of the three great pre-Colonial Mohawk villages (its site and relics ably mapped and described by Robert Hartley in POPULAR SCIENCE NEWS, May and June, 1896), when at the height of its power and population, evidently had a number of offshoots—small lodge or village sites, some of which are found in impregnable situations closely modeled after the parent town. The analogy presented by the ornamented potshards establishes the parentage of these places. The peculiar and characteristic notched angle is clearly shown in the illustration, being to the archæologist a veritable Hall mark of Maquas, or Mohawk, origin.

Were it not for this unfailing guide, and peculiar and distinctively ornamented pottery, it would have been quite impossible to say with assurance that the occupants of the Triangular Flat were of the Mohawk nation. So far as yet interpreted, the story learned from the flints and other objects of stone here found, give no clue to the nationality of the makers. The line of division between the territory held or claimed by the Mohawks and Mahicans (about 1600), as mapped by Beauchamp in "Aboriginal Occupation of New York," no doubt approximately correct, falls but a short distance eastward from this place.

Thus we have a lesson plainly outlined—the story told by the peculiar ornamentation of the humble potshard. Frey, digging in the kitchen refuse of Garoga, the last westward of the three great Mohawk homes, says of the peculiar Mohawk pottery, "as we go deeper into the bed of ashes, we begin to find fragments of that archaic pottery, which is peculiarly Mohawk. It is sui generis, and is one of the principal links that connect into one continuous whole the long line of Mohawk village sites, and not only so, but that connects these sites unmistakably with Cartier's village of Hochelaga; for in the museum of the McGill University can be seen many fragments of pottery, dug up on the site of Hochelaga which are identical in material, color, form and decoration with this Mohawk pottery which we find so abundantly in the refuse heaps of Garoga, and in all the other Mohawk village sites."



CHARACTERISTIC FORMS OF CHIPPED FLINT OBJECTS FROM THE TRIANGULAR FLAT.

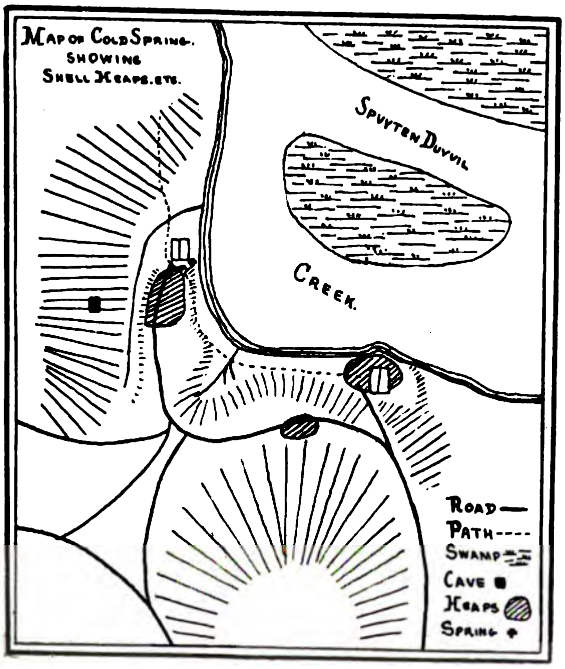
That the Triangular Flat was occupied but a few years at most as a dwelling site we may infer from noting the small extent of the pottery-strewn ground. Possibly these adventurous emigrants from Cayadutta were surprised and destroyed by their foe from the east, the Mahicans. In this supposition we could find an explanation for the abnormal number of small triangular arrow-heads strewn over the whole area of the Flat. It should be here stated that these arrow-heads differ radically in form from the long and slender forms found so plentifully at Cayadutta, though both are triangular and invariably unnotched.

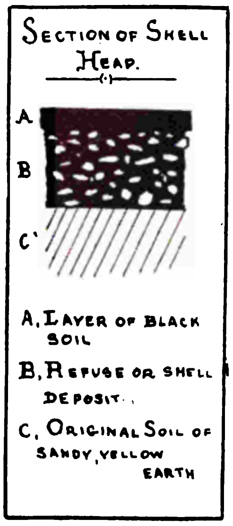
It is conceded by many archæologists that the triangular form of arrow-head was made and used mainly for warfare. In addition to other facts giving ground for this belief, an interesting discovery made in the summer of 1901, still further confirms it. But a short distance from Buffalo, N. Y., some human bones were unearthed of which one vertebra contains three small black unnotched, triangular arrow-heads deeply imbedded in the bone. If three shots found their target in so small an area, one vertebral section, what a shower of arrows must have lodged in other portions of the poor victim's anatomy! This most interesting and valuable relic was, fortunately, quickly secured to science by Mr. George A. Smith, curator of the Ethnology Building at the Pan-American Exposition, who placed it in one of the gallery cases of the Ethnological display, where it remained on exhibition from the time of its discovery and acquisition in August, until the close of the Exposition.

AN INDIAN VILLAGE SITE ON MANHATTAN ISLAND.

BY J. K. FINCH AND J. A. CHURCH, JR.

At the extreme northern end of Manhattan Island are evidences of an ancient Indian camp, consisting of a rock shelter and three refuse heaps. The "rock shelter" is a formation where the overhanging rocks form a small cave or shelter, which the Indians used as a dwelling place. All their rubbish, such as oyster shell, broken pottery and broken arrow heads, were dumped in a heap near by, thus forming the so-called shell heaps, of which there are several here located at Spuyten Duyvil Creek and Inwood. At Cold Spring there are three of these heaps close together, and the rock shelter is near; Cold Spring is situated on the southern side of Spuyten Duyvil Creek, at the extreme northern end of Manhattan Island.




Section of Shell Heap.
A
B
C
A, Layer of black soil
B, Refuse or shell deposit.
C, Original Soil of sandy, yellow earth

Arrowheads from Refuse Heap

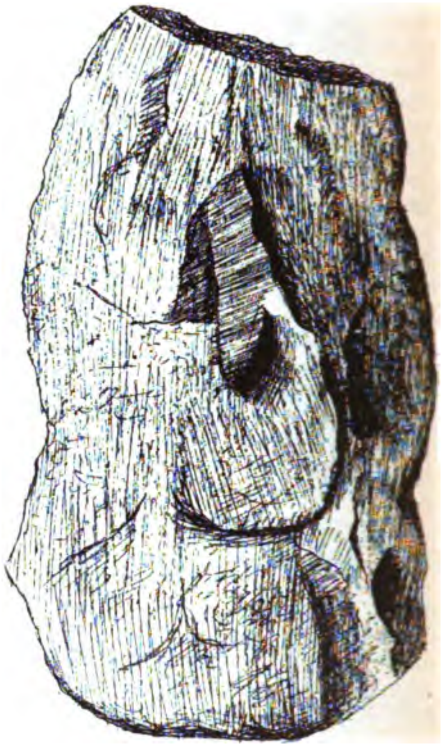
Bone Awl.

Scaphoid Bone of Deer

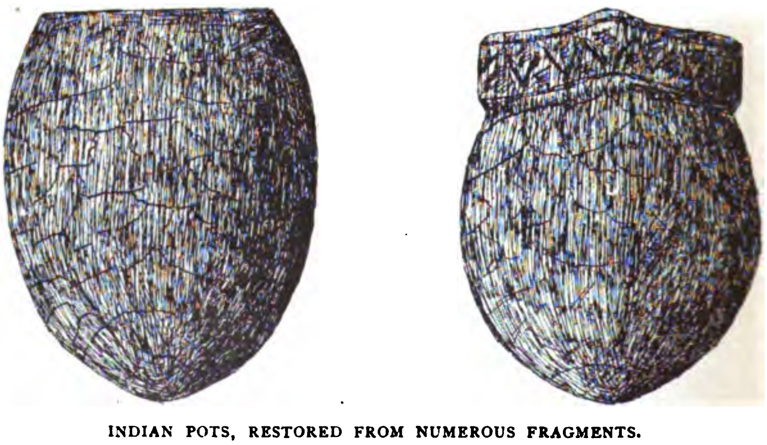
Method of holding a Pitted Hammerstone

The rock shelter was discovered and explored several years ago. It is at the foot of the hill which forms the most northern part of the Island, and faces east. This shelter was formed by several of the rocks breaking off the cliffs above and falling in such a manner that, by digging out some of the earth from beneath them, the Indians could make a small shelter. Probably it was occupied by one family, while the others lived near by. In it were found pottery and stone implements, together with turkey and deer bones. The hills to the south and west formed a protection to the camp from wind, and by Spuyten Duyvil Creek access could be secured to either the Hudson or East Rivers, and thus the sheltered position formed a most desirable camp site. The cold spring, from which the place takes its name, furnished an abundance of fresh water, and the Hudson and the Bay a good fishing ground, while deer were plentiful in the neighboring woods.

One of the refuse heaps is situated immediately in front of the rock shelter. The shells are found under a layer of black earth, and resting upon one of sandy yellow, which is the original soil, the black layer consisting of forest mold. We have a record which states that the Indians often made large catches of oysters, and not only used them at home, but also traded them with Indians from up the river. The extent of the heaps proves that large catches were frequent; and at Armonk, near a rock shelter, great quantities of marine shells were found, although this place is fifteen miles from the sea. This shows that constant intercourse went on between the Indians of the coast and those of the interior. The latter may have given in exchange material for arrowheads and other implements, as some specimens found near Cold Spring are of stone that is not found on the Island.



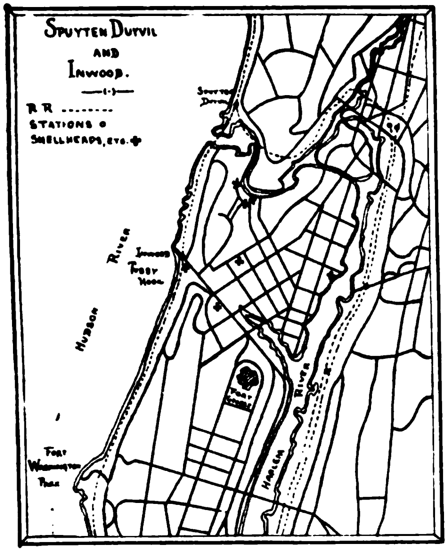
HAND AXE, 6 INCHES LONG.

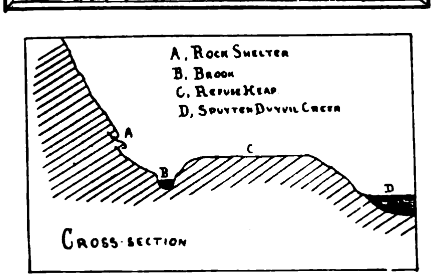


INDIAN POTS, RESTORED FROM NUMEROUS FRAGMENTS.

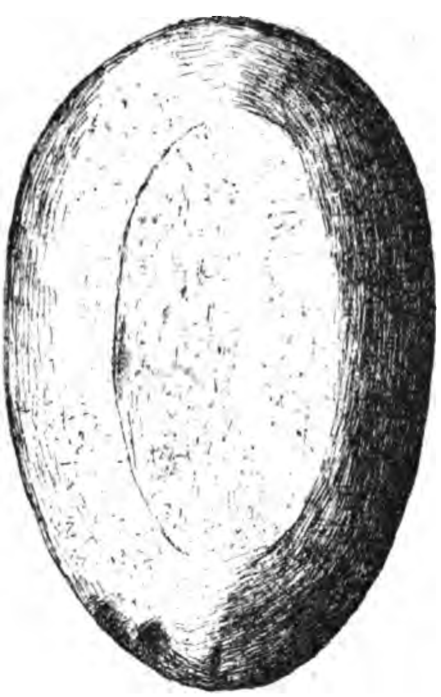
The Manhattan Indians were "the last of the Mohicans," and show Iroquoian influence in their pottery. This was of rough manufacture, usually made in a hole in the ground, although some pots have been found made by coiling. In the first case a hole was dug, having the shape of the pot which was to be made; this was lined with cloth to prevent sticking, and then the clay was put over the cloth. The coil-made pottery was formed of ropes of clay, which were coiled around in the required shape and then pressed together. To prevent cracking the Indians mixed powdered shells and sand with the clay. The pots were always made with pointed bottoms, differing only in the rims and decoration. On some specimens the rim in two opposite places rose to a point, an indication of Iroquoian influence. The decoration, consisting of geometric figures made up of incised lines, was wholly confined to the rim, and was sometimes entirely lacking. The surfaces of many pots show fabric marks, proving that the Indians manufactured a rough cloth; and as coil-made pottery is a development of basket-weaving, they probably made baskets.

The staple food of the Manhattan Island Indians was oysters. The refuse heaps are almost entirely composed of these shells, although occasional clam and scallop shells are found; at one place near Inwood, Mr. W. L. Calver found with some oyster shells part of a small lobster's claw, together with a portion of a turtle shell. Deer bones and teeth are frequently found in the heaps, and turkey bones also occur. Among those of the deer are the scaphoid bones, which are supposed to have been used by the Indians in playing a game. Corn and beans, which have been charred and thus preserved, have also been found. These were grown in gardens kept by the squaws, whose primitive hoes have been frequently unearthed. The only bone implements are awls.





The arrowheads are of a great variety of shapes, embracing the triangular, stemmed and notched forms, and are of flint, quartz, and argillite. A great difference exists between the chipping of various specimens, some of excellent workmanship and others being very rough. Arrowheads of deer antler have also occasionally been found. Of the hammer stones there are several types. The most primitive are without pits, and were often used for grinding purposes as well as for pounding. Rude axes have been found, some grooved so that a handle could be attached, and others without a groove for use as a hand axe. In common with almost all village sites near water, Spuyten Duyvil has furnished many notched and grooved stones used by the Indians as sinkers.



HAMMER AND GRINDING STONE.

That these Indians had intercourse with the whites is proved by the presence of clay pipes marked "R. Tippet;" these are of English manufacture, but Dutch pipes have also been found. Few people are aware that well within the city limits there exist extensive Indian remains, dating back to the seventeenth century. In a few years these will have disappeared, and the last trace of the original inhabitants of Manhattan Island will be gone, save for the specimens collected and preserved in museums.

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Bullet-Proof Vest.

Casmir Zeglen, the Chicago man who has been working some years perfecting a bullet proof cloth, now has his article on the market. A vest of the cloth a quarter of an inch thick, guaranteed to resist a revolver bullet, costs $50.

Various Topics

TELEGRAPH AND CIPHER BUREAU OF THE WHITE HOUSE.

BY WALDON FAWCETT.

An especially convincing demonstration of the facilities and achievements of modern telegraphic and telephonic communication is afforded almost daily in that branch of the United States government service known as the Telegraph and Cipher Bureau of the White House. This institution which constitutes an important factor in the exercise of the administrative functions of the Chief Executive, is located in a large room on the second floor of the White House at Washington, immediately adjoining the private office of the President. During the recent conflict between Spain and the United States, the apartment was popularly designated as the "War Room," from the fact that it was to or from this "central station" that all important messages relating to the conduct of the war on land and sea were transmitted.

However, the value of the work performed by this new adjunct of national governmental machinery varies only in degree, and the fact that its accomplishments, under ordinary circumstances, gain less prominence than those of the war period must not be interpreted as a reflection upon their importance. The bureau has been aptly termed the "nerve center of seventy-five million people," and indeed its sympathetic nerves cover not only American territory, but the entire globe. This "clearing house" for business of every description, which has the personal attention of the chief magistrate, has no counterpart in the equipment of any other ruler on earth, and diplomats and foreign officials who have been permitted to watch the workings of the system have been filled with admiration for its novelty and perfection.

To enumerate briefly the numerous objects of this unique headquarters of communication, which, by the way, is the only government telegraph office which is never closed night or day the year round, would be somewhat difficult; but, summed up, the task presented is to keep the President promptly informed of any happening of importance anywhere in the world and to as promptly communicate his commands and instructions in any matter bearing upon the interests of this nation or its citizens. When the President is absent from the White House, and particularly when he is traveling, the duties of the bureau are greatly complicated, since not only must all the regular functions of the institution be performed, but communication, as nearly continuous as possible be maintained with the Chief Executive. Finally, the bureau is entrusted with the work of transmitting the confidential messages from the government to American army and navy officers and diplomatic representatives abroad, a class of work in which the utmost discretion and secrecy is, of course, necessary.

From a scientific standpoint the greatest interest possessed by the Telegraph and Cipher Bureau is found in its marvelous equipment. The institution was planned and is conducted on a policy of system, method and concentration, and by the introduction of novel devices, many of which are the conception of the official in charge, it is possible to enable six telegraph and telephone operators to perform work which, under ordinary circumstances, would require the services of a force of fifteen or twenty men, and would be as costly in unnecessary time consumption as in expenditure of labor.

A switchboard accommodating twenty-seven wires is connected up single and duplex for telegraphic purposes, and by this means it is possible to secure at any time a direct wire to any city in the country. Moreover, this wire may be "held" for any length of time desired without danger that it will be used during the interim for other than official business. By this means, also, it is possible to make direct connection with either the French or English cables, or in fact any of the oceanic lines. This is a provision which has been made for emergencies. Ordinarily, cablegrams are transmitted through the offices of the various cable companies in New York City; but in case of accident or where the necessity was presented for great haste, it is possible for the White House operators to work direct with the last land office of a cable, as for instance, the one at Sydney, Cape Breton, Nova Scotia, and this has been done a number of times.

Early in the autumn of 1901, two double telegraph wires and two sets of duplex instruments were added to the already complete equipment of the Bureau. One of these new exclusive wires connects the White House with the cable offices in New York, and the other extra wire is for use in communicating with the President, wherever he may be, when absent from the White House. Possibly the most interesting phase of the work which devolves upon the Bureau, is that of maintaining practically constant communication with the Chief Magistrate when he is traveling by rail. The Bureau is in possession of a detailed itinerary of the trip giving the running time for every minute of the journey, and with this as a basis supplemented by a system of reports from all train dispatchers on the line over which the presidential train is passing, it is possible to place a message in the hands of the Chief Executive at almost any moment during the tour.

The twenty-seven telegraph wires which converge at the White House do not, however, afford as really marvelous a communicative system as do the telephone lines which keep the Executive Office in touch with the outside world. In the Bureau is a switchboard which virtually constitutes a regular exchange, at the same time partaking of some of the features of a private branch exchange. There are first of all three trunk lines which connect with the central telephone office in Washington and the long distance exchange. Connection is afforded with eight separate stations in various parts of the White House, and finally, seventeen miles of exterior wires afford communication with the various government departments, the government printing office, and Congressional Library. Each of these edifices is connected with a separate trunk line and "works direct" with the White House.

Nor does this exhaust the telephone equipment. There are private lines connecting the Executive Office with the United States Senate and House of Representatives, so that the President may talk confidentially with any member of Congress, and most interesting of all, as an adjunct for secrecy, is a telephone system which connects the President with the desks of the various Cabinet members. This latter system is automatic in its action, the central station being located in the garret of the White House and consequently there is no opportunity for even an exchange operator to overhear what passes between the President and his advisors.

The force at the "intelligence office" of the White House is constantly experimenting to secure time and labor-saving methods. On occasion operators receiving long distance telephone messages repeat them word by word to graphophones to be transmitted to the President at his leisure, and in some instances when there have not been sufficient operators to handle incoming business, graphophones, carefully gauged as to speed have been made to record long messages clicked off by the telegraph instruments, the operators transcribing by means of typewriters after the rush of work had abated. Col. B. F. Montgomery, the United States Signal Corps officer who is in charge of the Bureau, hopes to yet devise a means for utilizing the graphophone to record telephonic messages.

As an indication of the celerity with which the Bureau acts, it may be mentioned that within fifteen minutes of the time of the firing of the shot which resulted in the death of the late President McKinley, two wires,—telegraph and long-distance telephone,—connected the White House with the building at the Pan-American Exposition to which the wounded official had been removed.. During the time which intervened between the shooting and the death of the President a total of 4,351 messages was received or transmitted at the White House office. From the opening of the Spanish-American War, at which time the Telegraph and Cipher Bureau was established, until October 31, 1900, the office handled 453,765 telegraph messages.

A large proportion of the telegraphing during the war was carried on in the different codes of cipher. Telegraphic messages come to the Executive offices in ten different codes. The State Department, the War Department and the Navy Department each has three different codes and the President has a private code. The operators at the White House work in three "shifts," the hours being from nine in the morning until five o'clock in the afternoon, from five in the afternoon until midnight, and from midnight until nine o'clock in the morning.

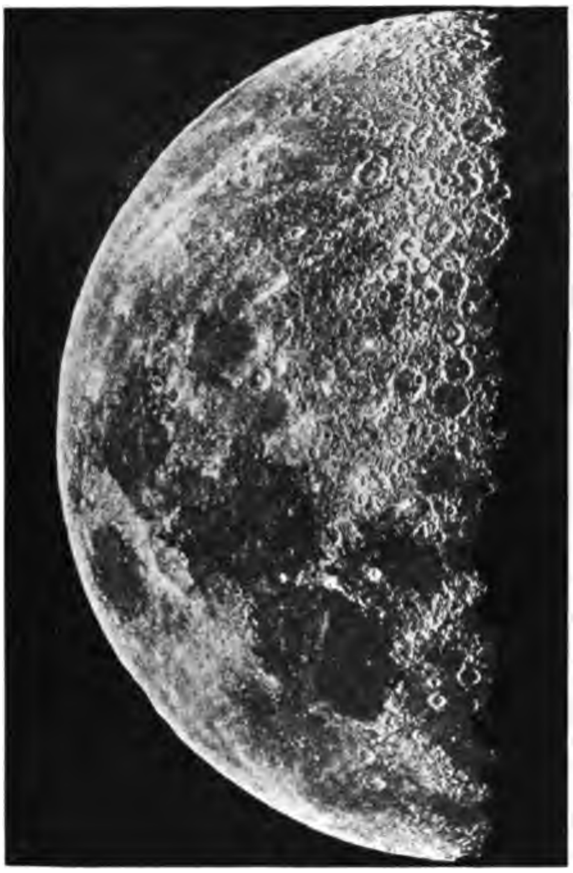
A very important feature of the Telegraph and Cipher Bureau is an immense map of the world, twenty feet in length and eight feet in height, on which is marked the exact position of every regiment, battery or troop in the United States Army, and every vessel in the Navy. In the map twelve colors are employed, each representing territory of one of the twelve principal colony-holding powers. The principal railroads of the world are shown, and the submarine cables are marked. Each detachment of the army and each vessel of the navy is indicated by a miniature flag mounted on a pin as a staff and bearing, in the case of a regiment, the number and strength and in the case of a ship, the tons displacement. The various branches of the military service and the different classes of vessels are indicated by flags of different colors. When any ship or body of men moves to a new post, a corresponding change is made in the position of the flag on the large map, so that the President may ascertain at a glance the exact distribution of the nation's fighting strength.

CRATERS OF THE MOON.

BY R. I. GEARE.

At a time when the subject of volcanoes is claiming such wide attention, it may be of interest to present a few facts regarding the craters which have been observed on the surface of the moon, and which, from the standpoint of size at any rate, throw our terrestrial volcanoes completely into the shade. The statements in this article are principally derived from papers by Mr. A. Cowper Ranyard, editor of Knowledge, Mm. Loewy and Puiseux, and others.

One of the most interesting of the lunar craters is "Tycho," which has been called the "metropolitan crater of the moon." While it is by no means the largest of them, it is a very striking feature of the lunar landscape, especially when the moon is nearly full and the shadows of the mountains have disappeared. This crater then appears as a conspicously white spot, from which radiate in all directions a large number of whitish rays that extend over more than a third of the visible hemis-



THE MOON; AGE, 7 DAYS, 21 HOURS.

phere of the moon, indicating that the crater has been the center of a colossal disturbance which seems to have shattered the lunar crust in all directions.

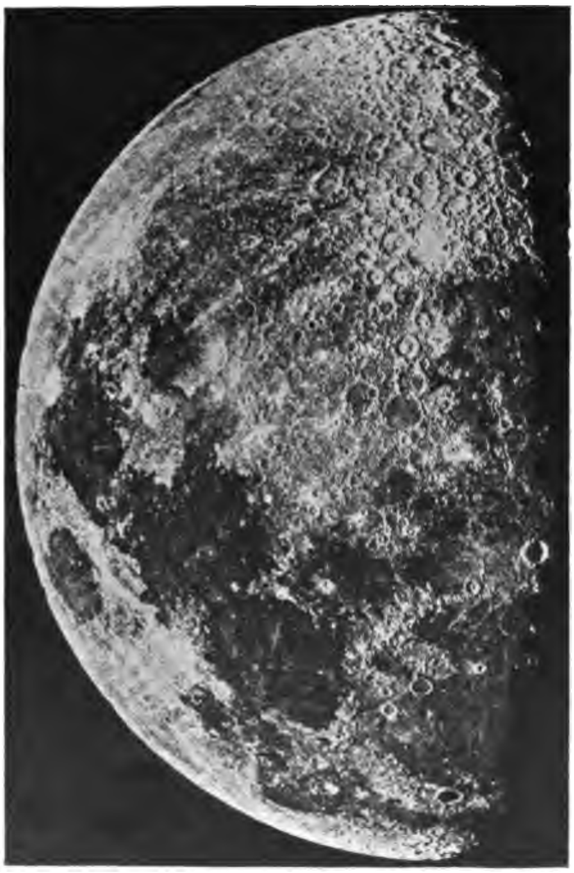
Although we are in the habit of regarding some of our volcanoes as immense affairs, even the largest of them, as already indicated, pales into insignificance before many of these lunar craters. Thus the ring of "Tycho" is fifty-four miles in diameter, while the crater "Clavius," lying to the south of it, is more than 140 miles in diameter. There are still larger ones apparently, for, says Ranyard, if the lunar "Apennines" and the other mountains forming a broken ring around the "Mare Imbrium" (Sea of Rains), are the remnants of a crater, it must have had a diameter of over 600 miles. By way of contrast, it may be added that our largest terrestrial craters are not more than fifteen or sixteen miles in diameter. So from this, it will be evident that such volcanoes as Vesuvius would appear as insignificant hills if dropped into the centre of the crater of "Tycho," whose ring-wall towers to a height of 17,000 feet above the plain which it incloses.

Reverting again to the moon's craters, we find that between the Caucasus and and the Lunar Alps, lies the crater, "Cassini," more than 37 miles in diameter, which was first observed by Dominique Cassini in 1680. Helicon and Leverrier, twin craters very close together, are seen in the southern part of the "Mare Imbrium," while Cichus, a crater of large size, forming part of the southern border of the "Mare Nubrium" (Sea of Clouds), has a parasitic crater which interrupts the regularity of its contour. Another crater enjoys the significant name of "Hell," and in its vicinity a bright spot is seen, in which are assembled several other craters.

In the middle of the "Mare Fœcunditatis" (Sea of Fertility), is a pair of craters named after Messier. From them, extending in an easterly direction, is a straight white bifurcated trail, resembling the tail of a comet. It is worthy of note that when under careful observation by Beer and Mädter, between 1828 and 1837, these two formations could not be distinguished from each other, whereas today they differ both in form and dimensions, and their dissimilarity is said to be so pronounced as to be appreciable by the casual observer. So, too, in regard to Linné, a white spot in the "Mare Serenitatis" (Sea of Serenity), several observers agreed in finding here a very deep crater, plainly visible. But in 1866, Prof. Schmidt pointed out that it had entirely disappeared, and in its place there was at that date only an extremely small opening.

These and numerous other changes in the moon's surface, observed largely by means of photography, suggest that an evolution has taken place, as marked as on our own planet. It is even claimed that plain manifestations of the circulation of water, of vegetation, and of life at one time, are not wanting.

Several theories accounting for the formation of lunar craters have been advanced. One is that the lunar surface consists en-



THE MOON; AGE, 8 DAYS, 21.5 HOURS.

tirely of ice and that the craters and pit-like depressions are due to the action of hot springs, the water of which has melted the ice above the vent. The water then returned to the warm interior of the moon, taking with it a part of the melted surface ice.

By a constant repetition of this upward and downward action, the terraced walls of the craters are supposed to have been built up above the level of the surrounding plains. This theory is not shared by Monsieurs Loewy and Puiseux, who argue that, if the lunar disk were covered with ice, there should be visible a luminous spot periodically following the motion of the sun. Ice possesses a marked power of reflecting light, yet neither photography nor visual observation have disclosed any such phenomenon present, and further, the measurements of M Landerer give a value for the angle of polarization of the surface of the moon differing from that of ice and agreeing much better with that of volcanic rocks.

Another writer, endeavoring to account for the existence of lunar depressions, says: "So far as the smaller craters are concerned, there is nothing incredible in the supposition that they were due to meteoric rain falling when the moon was in a plastic condition." To this theory objection has been made that the rings left by meteoric downfalls would be circular only when the falling matter happened to strike the moon's surface squarely. To this objection the author of the meteoric theory replied that he regarded it as far more probable, that, even when the surface was struck obliquely, and the opening first formed by the meteoric mass or cloud of bodies was therfore markedly elliptic, the plastic surface would close in round the place of impact until the impression actually formed had assumed a nearly circular shape. Later experiments by another eminent geologist tend to prove that when projectiles are thrown obliquely against a target of plastic materials, a crater-shaped hole of elliptic contour is the result. He assumes from laboratory experiments that, owing to the flat character of the Saturnian ring about the earth, "the moonlets must have approached the moon approximately in the plane of its equator, but the fact is not attested by the grouping of the craters in a medial zone." This authority further assumes that the axis of the moon's rotation has shifted under the successive impulses of the bombardment, and that the moon's equator has occupied successively all parts of its surface. In addition, it is his belief that the velocity of the impact due to the moon's gravity would be sufficient to melt the rocks of the lunar surface, and that they would during a short period behave as if they were composed of plastic material, but would become hardened before the craters could subside.

But be the causes of their formation what they may, this subject is an interesting one, and it is confidently hoped that, —largely no doubt through the agency of photography,—additional discoveries will be made from time to time concerning not only these vast holes in the moon's surface, but also touching the past and present physical and climatic conditions of the moon. The illustrations in this article which show a number of pit-like depressions on the moon's surface, are reproduced from photographs taken at the Observatory in Paris and accompanying a paper by Mm. Loewy and Puiseux, which was printed in the Smithsonian Report for 1898.

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Prehistoric Tomb Under Rome.

The Rome correspondent of the London Times, as quoted in Science, reports that Signor Boni, director of Excavations in the Roman Forum, has made another discovery of unusual interest. It has long been his conviction that the subsoil of a part of the Forum contains the necropolis of the founders of Rome and that, given the Aryan origin of those founders, the character of the tombs must be in accordance with the Aryan custom of cremation. Critics have displayed much scepticism concerning this theory, as also concerning the traces of Aryan development which Signor Boni has detected in the Forum; but he has once more silenced their objections by producing the object whose existence they had doubted or denied.

He has discovered a prehistoric tomb, believed to date approximately from the eighth century B.C., containing a large urn, or dolium, of black ware full of calcined bones, and several reticulated egg-shaped vases, besides a bowl and a cup with horned handles like those found in the terremare of the bronze age. The tomb is situated in the bed-clay some twelve feet below the level of the Sacred Way, opposite the Regia, and close by the Temple of Antoninus and Faustina. In some respects this discovery is the most important yet made in the Forum. One tomb is not a necropolis, but it is presumptive evidence of the existence of others.

Unless the Italian Government should, to its shame, restrict the funds necessary for the exploration of the lower strata of the Forum, the point will soon be settled. Meanwhile, it is to be noted that the reticulated vases of the tomb bear a striking resemblance to netted gourds, and that the covering of the funeral urn is a faithful reproduction of a conical hut roof—signs that they date from a primitive period. The tomb may be regarded as the extreme link in the further end of the chain of Roman history, as reflected in the Forum and illustrated by Signor Boni in the discoveries of the cippus under the Black Stone, the Rostra, the ritual pits, the massive Republican drains (beside which the Cloaca Maxima seems insignificant), the extraordinary underground gallery for scene-shifting, and others.

Mineralogy

[Edited by A. C. BATES].

Calcite.—This mineral is probably second only to quartz in the esteem of collectors. It presents a greater variety of forms than any other mineral. Its composition is carbon dioxide 44.0, lime 56.0. Its hardness varies with the direction on the cleavage face, but is placed at 3 in the scale. Cleavage highly perfect. Double refraction strong, hence the wide separation of the two rays into which the incident ray is divided, thus giving a double image of a spot or line seen through a cleavage fragment. The varieties are numerous and diverse in appearance, and are based chiefly upon crystallization and accidental impurities. Dog-tooth spar and nail-head spar have the forms suggested by the names. Breccia and all kinds of marble, lithographic stone, most all stalactites and stalagmites, travertine, etc., are varieties of calcite.

The finest group of transparent crystals come from Egremont, Alston Moor, and other places in the North of England. Some of these groups are made up of stout scalenohedral crystals clear as glass, while others have the tips of the crystals a beautiful Indian red color. Short and stout, also long and slender crystals, varying much in form and quality, also occur here abundantly. The finest large, clear twin crystals also occur in Cumberland. From the mines of Guanajuato, Mexico, have come twin and other crystals of Calcite in great variety and beauty. Very often the matrix of the calcite of this locality is quartz of different amethystine tints, and when this is of deep purple and the calcite milky white, as is often the case, the specimens make the most pleasing combinations known to the collector. There is one such magnificent specimen in the Roebling collection at Trenton.

From Joplin, Mo., come the wonderful honey-colored crystals, some of which have an interior of purple, and which occur here abundantly in both simple and highly modified forms. These crystals are broken from the walls of the small caverns in which they occur, and but few are doubly terminated. Some of the single points are of huge size and nearly all have highly polished surfaces.

There are many old and well known localities all over the world, some of which still yield fine specimens, notably the mines of Freiberg and others in Saxony. The best Iceland spar occurs in a large cavity in basalt near Helgustadir, Iceland, but as the quantity is limited and the demand large, it is likely to be soon exhausted.

Geodes from the size of a cocoanut up to a peck measure, lined with calcite cyrstals of many forms, are found at Warsaw,

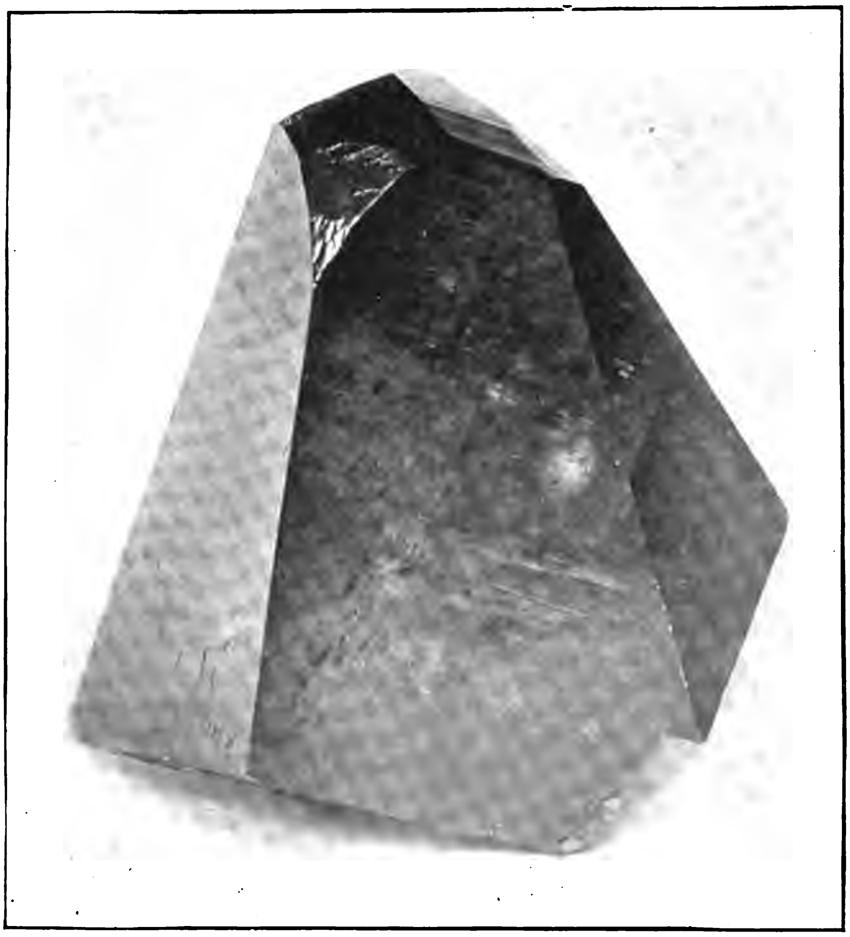
CALCITE; STANK S MINE, CUMBERLAND, ENG.

Ill. Calcite is perhaps the chief economic non-metallic mineral. Its use in the arts is both wide and varied. The lime of commerce is used in building, in soap making, bleaching and disinfecting. It is used largely as a flux in smelting ores, also as a fertilizer, and is the base of many preparations.

Calcite specimens of fine quality are comparatively cheap. A really fine series of forms and colors may be had at prices averaging fifty cents per specimen for a collection of about twelve different varieties.

Utah Minerals.—A catalogue of Utah minerals and localities with descriptive lists and notes for collectors, has been issued by Mr. Maynard Bixby, of Salt Lake City, for private distribution. Mr. Bixby has made a valuable collection of crystals and ores, and has been active in the distribution of great quantities of specimens from the localities which he has personally visited. The catalogue, besides being of special value to mineralogists and the amateur collector as a guide, shows that Utah produces a wider range of mineral species than any other state or territory of the Union.

Chromite.—The metal chromium is not used directly in the arts, but the ore, chromite, has a number of uses, some of recent discovery, which should cause deposits not now worked to become productive. The mineral chromite is used in the manufacture of brick for basic open-hearth furnaces. In one furnace over 400 heats were turned out before the chromite brick lining had to be replaced. It has also been used as a hearth lining for water-jacket furnaces in copper smelting. Its merits are that it is infusible, that it does not become friable when heated and cooled, that it is not attacked by the products formed in the fusion of copper ore, and that being so hard it wears away very slowly under the flow of the fluids over it. The value of chrome ore depends upon its percentage of chromic oxide. The standard ore contains 50% of oxide and increases in value from 75 cents to $1.00 per ton for every unit above 50%.



Courtesy of Mr. Geo. L. English. GOLDEN CALCITE; JOPLIN, MO.

Cinnabar.—The newly found deposits of cinnabar (the ore of mercury) in Texas have not yet been sufficiently developed to determine their value. There are but four places in the world where mercury in any quantity is found,—Spain, Austria, California and Texas. The Almedan mines of Spain were worked 400 years before Christ and are still producing heavily. The money for the conducting of the war with the United States was obtained by mortgaging these mines to the Rothchilds. The California mines, called the New Almedan, promise to be as productive as their ancient namesake.

Carborundum.—Few of the more recent inventions are of greater importance to the industrial world than carborundum, due to Edward E. Acheson. He worked in the laboratory for six years and then expended two years and a large amount of money in the effort te solve the problem of the direct conversion of heat into electrical energy. He was about to give up the idea of independent effort and seek for a salaried position, when he happened to remember an incident of the Edison laboratory, when in fusing clay and carbon the result was a substance harder than anything ever secured in the laboratory. He knew the great value of an abrasive in the industrial world, and concluded that this material would prove equal to, if not better, and certainly cheaper, than either emery or corundum. He was successful at once and carborundum was the result. The first consignment consisted of 200 carats which sold at 30 cents per carat. The process has been so improved that it is now sold at 10 cents per pound in the rough. Carborundum is made by fusing carbon, sand, sawdust and salt in an electric furnace under tremendous heat. It polishes the diamond, puts an edge on the sword, shapes the pistons of the great engines of the ocean greyhound, finishes shoe soles and kid gloves, and performs countless other services. As a by-product the company secured last year a million and a half pounds of pure graphite, a substance heretofore found only in nature.

Gold Found.—A recent decision gives any gold found by an employee on the public domain, of the United States to the finder, regardless of any claim on the part of the employer. A workman employed to grade for the foundation of a mill on the public domain found a pocket containing about $600 in gold. The employer took possession of the gold as of his right as an employer, but the court held that as the land was not his but a portion of the public domain, the gold was an adventitious find and rightfully belonged to the workman in his capacity as a citizen of the United States. Gold has been frequently found by railroad graders in Colorado.

A Fossil Man from Kansas.

In April of the present year, two young men living in the vicinity of Leavenworth, Kansas, in the excavation of a fruit storage cave near their residence, discovered a number of human bones. They paid but little attention to them, supposing them to be of little interest, but a brief reference to the discovery finding its way into the newspapers induced Mr. M. S. Long, the curator of the museum of Kansas City, a gentleman well known for his interest in, and as a collector of, things anthropological, to visit the locality. He recognized the scientific value of the find and secured such as remained of the bones discovered. Unfortunately, while the larger part of, if not the complete, skeleton had originally been present, many of the bones had been mutilated beyond repair or lost. A newspaper account of the find was widely published as that of a glacial man.

At the request of, and in company with, Mr. Long I have recently had the pleasure of making a careful examination of the locality whence the bones came, as also of the preserved remains themselves. This examination leads me to the firm conviction that the specimen is of great interest as representing the oldest reliable human remains hitherto discovered in North America. The reference of their age to the glacial period, though erroneous, was easily inferred from the presence of the characteristic glacial boulders lying on the side hill above the excavation.

The tunnel or eave excavated by the Concannon brothers is directed horizontally into the side of a hill to a distance of seventy-three feet, near the mouth of a small though deep ravine opening on the flood plain of the Missouri River, nineteen miles northwest of Kansas City, and within a few miles of Lansing, Kansas. The skeleton was found at the extremity of the tunnel twenty-three feet from the surface above, as determined by a ventilating shaft dug near by. The floor of the tunnel is a heavy stratum of Carboniferous limestone six feet in thickness, that outcrops at its mouth. The material excavated, nearly uniform in all parts of the tunnel, is river loess or alluvium, interspersed here and there by limestone fragments. Some of these limestone masses are of considerable size and lie, for the most part, horizontally, as though they had fallen from a neighboring cliff and had been transported by the water. The material also contains numerous snail and some clam shells, the latter with the valves united. The alluvium is so firm and indurated that the tunnel, about eight feet in diameter, has retained its shape without any protecting props or walls, nor has there been any caving of its walls or roof. The skull and larger part of the skeleton was found irregularly placed, according to the testimony of the young men, near the bottom of the tunnel, the mandible separated some five or six feet. That the skeleton was intrusive, had been buried, or its position due to a creeping or sliding of the material, is inconceivable and out of the question. That there had been any deception on the part of the finders is equally inconceivable. I discovered fragments lying on the floor of the tunnel near the place ascribed to the discovery and picked up numerous other fragments on the dump outside, including a phalange and a complete os uncinatum.

The bones were found where they were reported to be, and had been deposited there by the water, at or near the time of the person's death. The cranium itself contains positive evidence of its genuineness; not only is the characteristic matrix yet firmly attached to the bone, but indurated portions are included in its sinuses. The specimen is unquestionably a fossil and was found buried twenty-three feet below the present surface in indurated alluvium that has never been disturbed since its deposition. This alluvium is, moreover, of water deposition, and not æolian, or talus from the neighboring cliffs. Distinct lines of stratification are observed, one of them running clearly the whole length of the tunnel a little above the horizon of the skeleton.

The age of the skeleton is evidently post-glacial, but is nevertheless very great. Its horizon is about twenty feet above the highest water mark of the Missouri River and more than fifty feet above its present bed. Add to this at least twenty feet of river alluvium covering the fossil and we have evidence of a change of altitude in the Missouri River since the deposition of the fossil of at least forty and probably fifty feet. That is, the skeleton was deposited during the period of depression following the glacial epoch, during the time of the so-called Equus beds, the time of Elephas, Mastodon, extinct bisons, moose, camels, llamas and peccaries. I see no other possible conclusion to be drawn. I have examined the later Pleistocene deposits in Kansas in many places and have fossils of this sub-epoch from all parts of the state. I am confident that the Lansing man belongs in the same fauna.

Of the skull and other bones I will say little. I trust they may receive the attention of some professional ethnologist. Much credit is due Mr. Long for his appreciation of the value of the find, and for the care and infinite patience with which he has restored the badly mutilated cranium to its present satisfactory condition. The cranium appears to be of normal capacity, dolichocephalic, the forehead receding, the supraorbital and especially the supraciliary ridges prominent.—Science.

After Porto Rican Ferns.

Prof. A. W. Evans of Yale, and Percy Wilson of the New York Botanical Garden, have gone to Porto Rico to make some further investigations and collections of the flora of the island for the New York Botanical Garden. Special attention will be given to the small area of primitive forest yet remaining on the island.

Dr. Britton, the director in chief of the gardens, has received word of their safe arrival, but with the regrettable loss or non-arrival of the peat moss used in packing living plants to be shipped to New York. This is a keen loss, as it was especially desired to secure some large tree ferns for the collection.

These peculiar plants grow abundantly in the primal tropic forest, and are of particular interest as being the kind of plants which contributed so largely to the formation of our coal fields. Their collection is accompanied by many difficulties, as they grow in places difficult of access, and, being deeply rooted and covered with thorns, are not easily obtained.

Water Became Colored.

A strange phenomenon was observed at Teplitz, Bohemia. All the water of the mineral springs assumed a reddish brown color for about an hour, after which it became clear again. The inhabitants were intensely alarmed, as the springs constitute the principal income of the city. It is assumed by some there is some connection between this change of color and the volcanic outbreaks in many places. A similar incident occurred at Teplitz on November 1, 1775, and very shortly after the great Lisbon earthquake.

Photography

A HOME-MADE DUPLICATOR AND ITS USE.

BY E. H. W., JR.

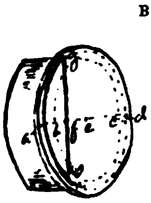


Fig. 1.

The making of trick photographs is often an agreeable variation in an amateur's work. To be able to take a picture of a man, arguing, boxing, fighting a duel with himself, etc., is both curious and amusing, and is quite easy for anyone to do. The first need is what is called a duplicator. This is simply a cap to fit over the front of the lens hood, with a hole cut in front of it. This hole is a section of a circle and is of such size that when the duplicator is put on the lens, all but about one quarter of the latter is covered. A duplicator may be bought for about twenty-five cents, but it need not cost you anything to make, as you can use the bottom half of an ordinary pill box, such as druggists use to hold a dozen pills. This will fit snugly over the hood of any modern four by five lens.

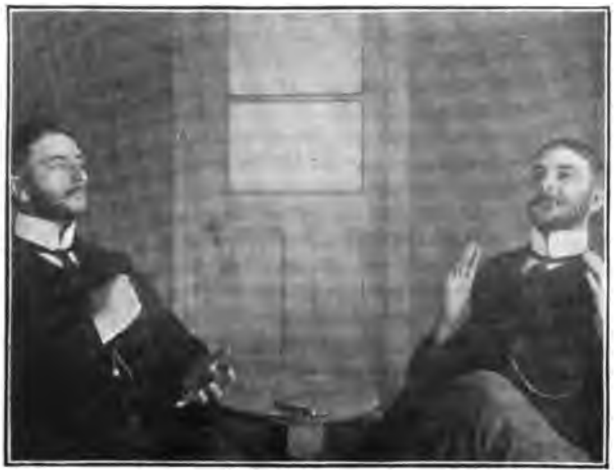


FIG. 2.—UNCONVINCED.

Take the bottom half of the pill box, and with a pair of pencil compasses, make two circles on the back, one the same size as your lens and the other ⅛ inch larger, see figure (1). See that you do not push the point of the compasses through the centre of the back at *e* as that would let light in where you don't want it. Draw the diameter *a d* and lay off *b f* on it equal to one half *b e*, draw the line *g f h* cutting the outer circle at *g* and *h* and with a sharp pen knife cut out the section *a g f h* marked with a solid line in figure (1). Ink the inside of your pill box to avoid reflection from the white card board, and your duplicator is finished.

Now let us see how to use it. We will try something easy first, say a picture of a man arguing with himself, as in the picture shown, entitled "Unconvinced." In a well lighted room set a small table with a chair on each side of it, and focus your camera on these so that the table appears below the central portion of the picture. Persuade a friend to let you make a victim of him and place him on a chair on the left side, in an attitude expressive of argument. Open your lens full and put on the duplicator with the hole on the same side as your sitter is on. On looking at the ground glass now you will find that the right hand chair and a portion of the right side of the table are screened from your sight. Get your friend in an easy position, put in your plate holder, draw the slide and make your exposure, which will be a long one as the duplicator acts like a small stop. You will probably have to give from ten to twenty seconds on a fast plate according to the light. If you take it out of doors of course the exposure is correspondingly lessened. With your shutter closed have your friend take the chair on the other side of the table, and this time pose as one who is listening but unconvinced. Take off your duplicator and put it on with the hole on the opposite side, taking the greatest care not to move the camera in the slightest degree. It is better not to risk even replacing the slide of your plate holder between the exposures.

Now make your second exposure, of the same length as the first, of course, and the deed is done. On developing the plate you will, if all has gone well, find two perfect images of your sitter in the attitudes assumed. The picture shown in (Figure 2) was made with a duplicator constructed as described above. The exposure required was twenty seconds. There is no end to the positions which can be assumed, but it is better to be sure and not have too strongly marked a back ground, as if the image of the sitter is thin in places, for instance where a black coat shows, the back ground may show through. This is particularly true of the central portion of the picture as that part is exposed practically twice as long as the sides. In figure (3) we have a rather more elaborate pose. I have called it "The Danger of Holding an Extra Ace." "The Man Behind the Gun" holds four kings, which by the way are hidden under his hand in the picture, and has drawn one ace, which shows at the front.

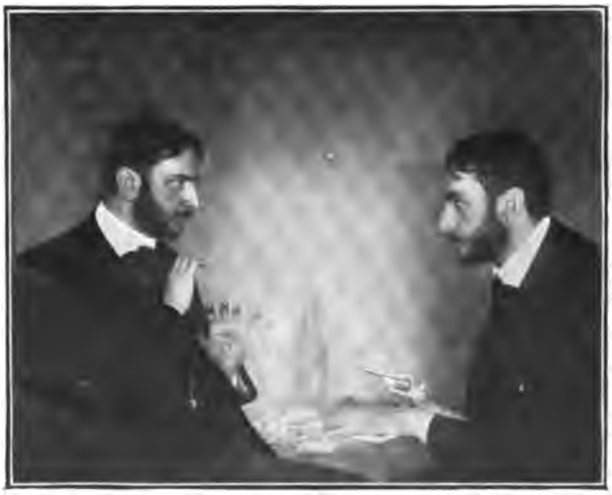


FIG 3.—THE DANGER OF HOLDING AN EXTRA ACE.

When the hands are shown down he discovers that his opponent has four aces himself. This causes our friend on the right to seize the stakes and cover the other party with his pistol, as there has evidently been cheating.

In making this picture I found it necessary to take the right hand figure, complete with the table arranged as shown. I then remove the table and got my friend to sit on the chair on the left hand side and exposed on him alone. I found this method necessary because in the first trial of this pose, in which the table remained during both exposures, the cards showed right through his hand on the table. This was owing, as I explained before, to the strong image made by the double exposure. In concluding let me say that if the following rules are observed one should have no trouble in making duplicate pictures.

First.—Have as plain a back ground as you can get. Second.—Do not leave any strongly marked object in the centre of the picture, during both exposures. Third.—Give plenty of time in indoor exposures and therefore let your sitters assume the easiest poses compatible with the composition of the picture, and if possible brace the head and shoulders so as to prevent indistinctness due to slight movement. Fourth.—If possible have some central mark on the background to sight on so as to avoid accidental overlapping of the images. I hope that any who try these duplicate pictures will have as much amusement out of it as I have had.

Photography in Astronomy.

A large amount of the knowledge concerning the heavens acquired in recent years, is due entirely to assistance photography gives to astronomy. By this means scientists locate stars that are invisible.

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NATURE STUDY IN EDUCATION.

The fact that knowledge of every kind is gained wholly from nature,—from careful observation, the study and application of natural laws—is more fully realized to-day than two, or even one decade ago. Fortunate are they of the present time who are taught not merely to memorize from books, words and sentences, which are of doubtful benefit to them in after life, but to systematically observe the wonderful workings in the world about us. That almost universal attention is now turned to nature study as an important feature in education, is shown by the fact that some of our leading dailies occasionally make editorial mention of it. The Evening Sun (New York) editorially expresses the need of nature study in our seats of learning in such a manner, that we think it well to quote the following:

"Not many years ago a noted man of science remarked that a modern university graduate, who would blush at being detected in the use of a false quantity in Greek, would cheerfully confess ignorance of the action of a common suction pump. This is not wholly applicable to the university man of to-day, who, it must be confessed, is generally free from prejudice in the matter of classic syllables. It still holds good as far as the pump goes, and it is true, as Lord Avebury (Sir John Lubbock) observed the other day, that "we have all met persons who have taken a university degree, and yet do not understand why the moon appears to change its form, who think that corals are insects, whales fish, and bats birds—who do not realize that England has been over and over again below the sea, and still believe that the world is not more than 6,000 years old."

Some attempt has been made of late years, both here and in Europe, to dispel this common ignorance. It was at a conference on subjects relating to the study of nature in English schools that Lord Avebury made the remark quoted above. He went on to say that an evil tendency of the day was to specialize the education of boys from the beginning of school life. Specialization should not begin before the age of 17, or 16 at the earliest. At the first a child should be taught something of everything; afterward, if possible, everything of something. He should have a general knowledge, to begin with, of the world and its relation to the universe; he should be instructed in the elements of physics, in the elements also of biology and geology. Lord Avebury would, besides, have him study arithmetic, language, possibly music and certainly drawing, as 'almost, if not quite, as important as writing'; but in his address he laid emphasis chiefly on the study of nature.

An obvious benefit derivable from the course recommended by him would be the employment of faculties at present largely neglected in the education of children. Instead of having their heads filled with facts and data, they would be taught to take an intelligent interest in their surroundings and to observe at first hand instead of accumulating and half digesting the observations of others. In this sense the study of nature as a means of culture is of vast importance, beyond the immediate value of the knowledge actually acquired in the course. This is recognized formally at the present day, but attempts made to encourage the teaching of science have heretofore been very half hearted. What does the average man know of the world he lives in? Our schools give instruction in biology, geology, botany, astronomy and physics among other things, but what does the average man know of these subjects? Anatomy and physiology are "taught" in our schools, but how much can the average man tell you of his bodily constitution and functions? He may be able to indicate with reasonable accuracy the whereabouts of the vermiform appendix, because it is associated in his mind with appendicitis; but he would be gravelled at once if asked to explain roughly the process of digestion. The truth is that his interest and curiosity in all branches of science are confined wholly to what is sensational, spectacular and odd. He will talk enough and brag enough about his country's achievements in various sciences, but his boasting is generally snobbish, inasmuch as it is not founded on any real knowledge or personal curiosity in the matter. Recently the American Association for the Advancement of Science held its fifty-first annual meeting at Pittsburg. How great was the popular interest in its doings? And how many of those who talk about America's contributions to science are aware that Prof. Asaph Hall, who presided at that meeting, is the discoverer of the moons of Mars? How many are aware that the moons exist except in the imagination of the astronomers of Laputa?"

It has always been the aim of the editors of POPULAR SCIENCE NEWS to educate, to uplift the mind, and to promote an interest in nature. For, after all, our education really begins when the school days end; and the signs of the times seem to indicate that "nature study"—the observation of birds, animals, trees and flowers—has come to stay.

THE HEAVENS FOR SEPTEMBER.

BY PROF. MALCOLM McNEILL.

The constellations:—Cassiopeia is in the northeast at about the same altitude as the Pole star. Andromeda is nearly due east at about the same height. Perseus is low down in the northeast and Auriga is rising. Aries is also rising nearly due east, while Pisces, Aquarius and Capricorn form a line from the east point to the southern meridian. This line of zodiacal constellations is continued through the southwest quadrant by Sagittarius and Scorpio, the latter just setting somewhat south of the west point. Aquila is high up southwest of the zenith, Cygnus is in the zenith, Lyra is just west of the zenith, with Hercules, Corona and Bootes below, the latter near the northwest horizon. Ursa Major is low down near the horizon, west of the north point.

The Milky Way is in fine position in the early evening, running from the northeast horizon between Auriga and Perseus through Cassiopeia and Cygnus in the zenith, then between Aquila and Hercules toward Sagittarius in the southwest horizon. The cleft beginning in Cygnus and continuing to the southwest horizon is especially noticeable.

Phases of the Moon, Eastern time:

New Moon.	Sept.	2, 12 h. 19 m. A.M.
First Quarter,	"	9, 5 h. 15 m. P.M.
Full Moon,	"	17, 1 h. 23 m. P.M.
Last Quarter,	"	24, 11 h. 31 m. A.M.

The full moon which comes nearest the autumnal equinox is known as the harvest moon; and for several nights the daily time of retardation of moonrise will be much less than the average.

The autumnal equinox, the time when the sun crosses the equator from north to south, and the days begin to be shorter than the nights, occurs this year on September 23 at 7 P.M., eastern time.

Mercury is an evening star throughout the month and comes to greatest east elongation on the night of September 24; but eastern elongations which occur during the autumn do not offer favorable opportunity for naked eye views of the planet, because it is much farther south than the sun at these times. At this particular elongation the effect is intensified because Mercury is nearly as far south of the ecliptic as it can be. So it results that although the greatest elongation is a wide one, 26°, coming only one week from aphelion, the interval between the setting of the sun and of the planet is less than one hour, and Mercury can not be seen by the naked eye except in especially good atmospheric conditions. On the afternoon of September 20 it approaches very closely the first magnitude star, Spica, Alpha Virginis, but the sun is still above the horizon at the time of closest approach.

Venus is still a morning star, but it is beginning to overtake the sun in their common eastward motion. At the beginning of the month it rises not quite two hours before sunrise, and at the end of the month only an hour and a quarter before the sun. It moves about 35° eastward and southward in the constellation Leo, and on September 11 passes quite close to first magnitude star, Regulus, Alpha Leonis.

Mars is also a morning star, but it is gradually falling behind the sun in their common eastward motion, and consequently rises a little earlier at the end of the month than at the beginning. On September 1 it rises at about 2 A.M., moves about 19° eastward from Cancer into Leo, and on September 30 it is about 12° west of Regulus. Its actual distance from the earth in miles is slowly diminishing and it is gradually growing brighter, but it has not improved on its minimum very much as yet.

Jupiter is in fine position for evening observation. It passed opposition with the sun early in August, and is now at a good height in the evening twilight. It does not set until long after midnight. It is in the constellation Capricorn with no bright star near it; it is still retrograding, but at a diminishing rate. The whole motion is less than 2°, and toward the close of the month the planet is nearly stationary.

Saturn is also in fine position for evening view. It is about 17° east of Jupiter and in the extreme western part of Capricorn. Its motion is small during the month; until Sept. 26, it moves slowly westward, then it begins to move eastward, but the whole motion is hardly perceptible to the naked eye. Toward the close of the month it sets before midnight. Jupiter and Saturn have been gradually drawing nearer each other for some months, but soon after the end of September they begin to separate again.

Uranus is in the southwestern sky in the evening, but is setting earlier than it did during August. Toward the close of the month it sets only a little after 9 o'clock, and owing to its faintness it cannot be well seen within two hours of its time of setting. It is still in the southern extension of Ophiuchus.

Neptune is in the western part of Gemini and rises shortly after midnight.

Radium.

At the recent annual exhibition of the Societe de Physique in Paris, Prof. Curie exhibibited a piece of pure metallic radium. It was about an inch in diameter each way, and it had cost $2,000 to extract this small quantity from several tons of barium salts. The radium shines like a lamp, and also causes various other substances to glow when brought near it.

Hall's Journal of Health

FOUNDED BY DR. W. W. HALL 1854

VENTILATION OF MIDDLE-CLASS DWELLINGS.

BY FRED. T. HODGSON.

II.

Good ventilation means the admission into a room of an abundant supply of pure air of the proper temperature. Air coming from across swamps, stagnant pools, the yards of abattoirs, or other similar places, should be rigidly excluded and every opening in the direction of such places should be closed, when the wind is from their direction, for the insanitary effects of air from such places may be felt for miles. Good fresh air consists of the following components, which vary but slightly in proportion to one another, though they are constantly varying in an infinitesimal degree. The following table may be accepted as fairly correct for American open air:

Name of Gas.	Symbol.		Proportion by volume.
Nitrogen..........	N	....	7790 60
Oxygen...........	O	....	2065·94
Carbon dioxide....	CO_2	....	3·36
Vapor of water....	H_2O	....	140 00
Ammonia.........	NH_3	....	0·03
Nitric acid........	HNO^3	....	0·005
Ozone............	O_3	....	0 015
Argon............	A	....	Infinitesimal traces.

Exhaled air contains more carbon dioxide and water vapor, but less oxygen than before inhalation, and also carries floating in it organic microscopical impurities of our decomposing bodies. It is fifteen degrees warmer than before inhalation, though its temperature never exceeds blood heat, 98°, and only attains this temperature when the thermometer marks more than 80° in the shade.

The humidity of fresh air varies greatly and quickly; a rise or fall of 10% often takes place in an hour. An increase of temperature reduces the humidity—the damp is dried out of the air, so tó speak—while a fall of temperature increases the dampness, the vapor becoming condensed.

In summer, the open air is, on an average, 18% less humid than in winter, 62% being about the summer average, and 80% the winter. Up to a point dry air is more healthy than damp air. Care, however, should be taken not to dry the air too much, which is often the case with some forms of hot air appliances and stoves. Under such circumstances the air has a peculiar and objectionable odor, and is apt to cause throat troubles or irritate those already existing.

Air is vitiated in many ways, some of the ways of which are unavoidable. A No. 5 gas jet vitiates the air as much as four persons would, an argand burner as much as six men, and a gas incandescent as much as one man and a half. An oil reading lamp vitiates the air as much as four men would, while a large central table lamp spoils the air as seven men would. The vitiations, however, are spread evenly through the room, except heat from gas jets, which always goes to the top.

The permissible vitiation for perfect healthiness is represented by the difference between ·04 and ·02%, or, in other words, is equal to ·02% of CO_2.

An adult in ordinary health will exhale six-tenths of a cubic foot of CO_2 per hour, thus vitiating 3,000 cubic feet of air in that time, this being consequently the theoretical allowance per person in rooms which are constantly occupied.

"Ordinary" air, that is, air as we get it in towns and villages, contains about ·02% of carbonic acid gas, or carbon dioxide (CO_2), which proportion may be raised to ·04% without any harmful results. If, however, the proportion exceeds .06%, it is positively harmful, and exceedingly oppressive.

Air is warmed practically by one method only, viz.: By contact with warm solid bodies. It is not possible to warm it by shining radiant heat through it, no matter how hot the source of fire may be. The fire or source of heat warms the floor, the body, the furniture and the walls of a room, and the air is warmed by touching their heated solid surfaces.

Curious Surgery.

The Indians of Brazil have a curious method of stitching up a gash, which is quite as efficient as a silver wire or prepared silk of the modern surgeon, and much easier to do, besides which there is no necessity for a skilled hand, and the materials are handy almost anywhere in the Brazilian forest. These materials are a species of very large ant, which has mandibles which can bite through almost anything. One of the peculiarities of this ant is that when it catches hold of anything with these jaws it cannot be made to let go. Even if the rest of the body is pulled off, these jaws still keep their hold.

What the Brazilian Indian does when he has received a gash is this: He catches some of these ants, and, holding them to the wound, which he has previously closed together, lets them bite. They fix their mandibles on each side of the wound, and then he pinches off the rest of the body. The jaws do not come apart, and so a row of these ants' heads keeps a wound together as well as the surgeon's needle and wire would do, and as the bite of these ants is not poisonous, this rough-and-ready surgery is quite efficient.

Red Spectacles for Seasickness.

Bright red spectacles, accompanied by internal doses of calomel, form a new German specific against seasickness. It is deduced from Epstein's investigations on the influence of color on the blood vessels in the brain. Seasickness is due to lack of blood in the brain, while red sends blood to the brain with a rush.

Notes on Drowning.

Peter S. McNally, a long-distance swimmer, says that most people believe that the cramp is the most dangerous foe of the swimmer. But it isn't. Of course, a cramp in the stomach would be dangerous, but it is rare. With an ordinary cramp in the arm or leg many swimmers get scared and the scare is responsible for their drowning. But the majority of people who can swim, who are drowned in the summer months at the seaside resorts, are drowned not because they are attacked with cramps, but with fits of apoplexy and heart trouble. A man with any affection of the heart is liable to instant death if he steps into cold water.

One of the greatest dangers to seaside bathers, and one of the things that bring on apoplexy, is the cooling-off process. Many people undress and then wait on the sand, saying they'll not go in until they get cooled off. If they are really overheated they should not go into the water, but if they are ordinarily warm then it is all right. But don't go in to bathe unless your body is in a glow.

Now and then we hear that a drowning person has thrown up both hands and then sunk. This can't be so. Only an expert swimmer can throw up both hands while in the water. I mean throw up his hands so that people near can see his arms out of the water.

A drowning man may sink fifty times and again come to the surface. There is no such thing as "the third and last" time. Children when drowning will sometimes struggle in the water for twenty minutes. Some people who are not strong enough to struggle just sink once and that is the last seen of them alive, for in that once that they go down they have swallowed sufficient water to strangle them. A person who drowns is practically strangled to death. Some people say that death by drowning is an easy death, and that the person drowning hears sweet music and all that sort of thing. I never heard of any one who was strangled having an easy ending.

Now as to the way to handle a person who is in danger of drowning. We hear how many lifesavers work by punching the drowning person in the face, but such a blow would not stun a struggling person, because the person who strikes has nothing but the water to brace him for the blow, and where there is no resistance there can be no force. A person who is struck in this manner in the water is drifting and there is no resistance to the blow. The best means to adopt in saving the life of a person drowning is to get behind him, press the thumbs under his ears and duck his head until he becomes manageable. I have saved the lives of sixty-five persons in this way.

Rate of Breathing.

A healthy person breathes about twenty times a minute.

Eye Strain.

The symptoms of eye strain are pain in the temple, pain in the back of the head and neck, red eyelids, and inability to see at a great distance or to read long at a time. The eyes become tired, and vision blurred; there is strabismus or cast in the eye, and a tendency to avoid light. The eyes are partly closed; there are twitchings of the lids, sick headache and dizziness. Eye strain may cause chorea and other nervous diseases. It brings on neuralgia and headache that medicines fail to cure. Nearly every condition recited above, if brought about by defective vision or an abnormal state of the ocular muscles, can be relieved by glasses. The fitting of glasses is, at times, a very difficult task, and should be intrusted only to a painstaking physician who thoroughly understands the different defects and diseases of the eye, and is skilful with the appliances used for the scientific selection of proper lenses.

Steam for Complexion.

A thorough steaming has a wonderfully good effect occasionally in clearing the complexion. It may be accomplished by holding the face over a basin of hot water and keeping in the steam with a towel which covers the head and the basin, forming a sort of tent. After steaming for a short time, wash the face well with a good superfatted soap and warm water, and then douche the face with cold water. The soap does the work of cleansing, the hot water removes the suds, and the cold closes the pores of the skin, which it braces so that it is not made too sensitive to bear the effects of cold winds, or of the sun.

Sea Bathing.

Persons in a delicate state of health commence by taking one or two tepid salt-water baths, and then one or two quite cold, by way of a preparation for the open-air bath, which should be taken about eleven or twelve in the day, and, if possible, in bright sunshine. The first bath should be little more than a plunge in and out, gradually extending the time to five or ten minutes. Brisk rubbing with a rough towel and a sharp walk or run should follow. The following advice should also always be borne in mind:

Avoid bathing within two hours after a meal, or when exhausted by fatigue or from any other cause, or when the body is cooling after perspiration, and avoid bathing altogether in the open air if, after being a short time in the water, there is a sense of chilliness with numbness of the hands and feet, but bathe when the body is warm, provided no time is lost in getting into the water. Avoid chilling the body by sitting or standing undressed on the banks or in boats after having been in the water, or remaining in too long, but leave it immediately there is the slightest feeling of chilliness, or any sensation of discomfort.

Blinking.

Opticians and oculists will, perhaps, find some help in the following paragraph, which bears on a habit quite common among persons of a sedentary occupation:

If you find yourself blinking your eyes rapidly without any cause, stop it at once, or it will grow into an incurable habit that will make your eyesight fail comparatively early in life.

Natural blinking is necessary to clear and moisten the eye. The average number of natural blinks is about twenty per minute. But a nervous blinker will get in something like a couple of hundred in a minute in bad cases. The result of this is a big development of the eyelid muscles. It besides involves counter irritation, which acts on the optic nerve, and renders the sight daily more weak and irritable.

Once contract this habit, and you will find you cannot bear a strong light or read small type, and the eyes get worse and worse. The cure consists in keeping the eyes shut for at least ten minutes every hour and bathing the lids in warm water.

Getting Chilled.

Nature's provisions against the consequences of a "chill" and the prevention of a "cold" are sneezing and shivering. A violent fit of sneezing often saves a chilled body the depression or "shock" to which it has been subjected, and this shock may in its first impression be very limited in its area; for example, the small extent covered by a draught of cold air rushing through the crevice of a door or window. The nerve centres are roused from their "collapse" by the commotion or explosive influence of the sneeze. If sneezing fails Nature will try a shiver, which acts mechanically in this way. If this fails, effects are likely to be very serious, and bad consequences may ensue.

Mosquito War Troubles.

Prof. John B. Smith, N. J. State Entomologist, met with a decided refusal when requesting a permit to kill such birds, for investigation, popularly credited with destroying mosquitoes, or feeding on insects. The reason given by the Fish and Game Commission for refusing Prof. Smith's request is that for years the agricultural department at Washington has carried on this search of bird diet, and all necessary knowledge on the point desired can be gained from that quarter. This would avoid the necessity of slaughtering hundreds of the too fast disappearing song and insectivorous birds.

Bread and Germs.

A Russian physician asserts that new bread is far more beneficial to the consumer than that which has been cut and exposed to the air, and has had time to gather the numerous germs, which find in the material a nutrient medium.

Correspondence

The Texan Rock Lizard.

Editor POPULAR SCIENCE NEWS:

This beautiful lizard, the Holbrookia texana, of Troschel, is a common species throughout the greater portion of Texas, especially in the western, central and southern sections, and is one of the most abundant saurians of the Plateau fauna. As far as known to the writer, it does not occur in the extreme northern and eastern sections of the state. Prof. Cope has taken it at Lake Valley, New Mexico, and Mr. E. Wilkinson at the city of Chihuahua, Mexico; these, I believe, being the extreme western and southern limits of its range, as far as known.

Throughout McLennan County it is the only rock-haunting species that is at all common, although another species of Holbrookia occurs, i. e., Boll's Spotted Lizard (Holbrookia maculata lacerata). On the bluffs of the North Bosque river, near the village of China Springs, the dark-colored Boll's Lizard seems to be in the majority; as I have observed but two or three specimens of Holbrookia texana there; but in all other suitable localities, the lighter-colored species is the prevailing form. In this species, the hind legs are very much lengthened, being almost half the length of the head and body. The tail is very much depressed at the tip. About one-fourth of the specimens collected by the writer have had imperfect tails.

When by accident one of these lizards loses a portion of its tail, there is a fresh growth, but sometimes a most curious one. One small specimen, which had lost the entire caudal extremity, close to the anus, had a new appendage not over half an inch in length and of the shape and color of a sharpened pencil point. In all cases where there is a fresh growth, the new tail or portion of one, as the case may be, lacks the usual black markings of the under surface. The following is a color description of this species, from Prof. Edward D. Cope's "Crocidilians, Lizards and Snakes of North America." (My own notes in parenthesis).

The upper parts of this species are of an olivaceous or reddish-gray, the back with a series of nine or ten small, dusky, rounded blotches, sometimes very obsolete; continued on the upper surface of the tail as a single series of undulating or somewhat W-shaped bars. All these marks are suffused behind with a lighter tint than the ground color. In the posterior half of each side are three parallel black crescents, extending from back to belly, the convexity posterior, the extremities of opposite ones separated above and below by ten or twelve scales. The borders and intervals of these crescents are generally yellowish, lighter than the ground color; the underparts are of a yellowish color, suffused with greenish on the sides of the belly, especially about the black marks. (In some specimens there is a patch of bright green on the sides.) The head has sometimes a greenish or light plumbeous tinge: the upper part of the head is faintly blue, varied with yellowish. (All of my specimens have lacked the greenish, but never the lead colored tinge) The under surface of the tail shows from three to eight conspicuous, transverse large bluish-black spots in continuation of rings encircling the tail, which are quite distinct above. The female has a series of lead-colored blotches along the sides, nearly as broad as high, subcrescentic, with the tips truncate and close; there are two oval spots on the side of the belly, and in its white ground, just below two of the lateral blotches mentioned.

During the breeding season, which is during May and June, the under parts are bright crimson-red in the female and bright sulphur yellow in the male. Along the banks of the Brazos river, north of the city of Waco, are high rocky bluffs, the summits of which are crowned with cedar and arborvitæ. Here the Texan Rock Lizard occurs, but is not very common. When disturbed it scampers down the sides of the bluffs, running with great rapidity, with its tail curved upwards over its back. On several occasions I have chased them into the water and they escaped by swimming a couple of feet away from the shore for a short distance, then heading for the bank, up which they quickly scrambled. I have found these lizards inhabiting the lower levels in several old rock quarries. Here when they were disturbed in close quarters, they would attempt to escape by concealing themselves under flat stones, but if none were conveniently near, would climb up the walls and hide in crevices and fissures caused by blasting.

This is a hardy species, as I have collected specimens as early as the 20th of March, and in mild winters, as late as the first week in December. This would indicate, that as a rule, these lizards do not hibernate more than three months. Were it not for the peculiar habit this species possesses of carrying its tail curved over its back, thus displaying the conspicuous black markings of the lower surface, it would often be difficult to distinguish them from the rocks among which they live, and with which the light colors of their bodies harmonize well.

During the month of October of the past year, I visited Cottonwood Creek, a small stream (at the time almost dried up), about seven miles to the west of Waco. This stream flows through the prairie land, through a bed of white rock. In the dry bed of the stream are numerous flat stones, from a few inches to several feet across, and among these as well as in crevices in the rocky bluffs, the Texan Rock lizard makes its home, and is far more abundant than I have found it in any other locality. Here I obtained thirty-nine during one forenoon, as well as almost forty specimens of other species of reptiles and batrachians.

Among the serpents taken on this occasion were several "Coach-whip" or Racer snakes (the Zamenis flagellum of Shaw), and the stomachs of these Ophidians I found to contain specimens of this lizard only. It seemed to me to be rather odd that the Coach-whip should show such a preference for this agile saurian, when Leopard frogs (Rana pipiens) and Nebulous toads (Bufo valliceps) were very common in or near the few small pools yet remaining in the bed of the stream, while Lined lizards (Cnemidophorus gularis) were very abundant along the grass crowned summits of the banks and in the prairie land on both sides. In one instance, I was in pursuit of a rock lizard and had chased it down a bluff, and in its efforts to escape it headed for a clump of weeds. When my quarry was within a few inches of these weeds, I caught a glimpse of a serpentine head and a sinuous body as a Zamenis flagellum took it in charge and glided away. When the serpent was captured the tail and hindquarters were protruding from its mouth.

On several occasions I have chased these into plowed fields, but have never been able to induce it to climb a tree in its efforts to escape, although I can see no reason why it should not be able to do so, as its claws eminently fit it for climbing of any description. My observations on the breeding habits of this species are very limited. A small female from Hewitt, deposited four eggs about three-eighths of an inch long and shaped like those of other iguanian lizards, in a small quantity of earth and sand in a corner of the box in which it was confined. I covered these lightly with sand in a screened box and left them in a sunny place, with the expectation of their hatching, but my hopes were never realized, for they simply dried up. The food of this species consists principally of insects, although I am certain that some vegetable matter, as the blossoms and leaves of plants, sometimes varies this diet. I have found portions of scorpions in the stomachs of the larger specimens.

J. K. STRECKER, JR.

◆

Volcanic Activity of Mount Redout.

Editor POPULAR SCIENCE NEWS:

Some exciting advices have just reached San Francisco, Cal., from Valdes, which is located on Prince William Sound, in Alaskan waters. These reports are in reference to the state of Mount Redout, which is situated in the Cook Inlet country. On May 10th the mountain began to pour forth vast and dense volumes of smoke. This continued with but little intermission for nearly a week. For several nights the advices say, the flames were visible At latest accounts the mountain was giving unmistakable tokens of volcanic activity. Mount Redout is much more active now than it has been for a long period.

The Indians throughout that region are greatly terrified, and many have sought safety in flight, going to the farther end of the Kenai Peninsula. The whites are also very apprehensive of a disastrous eruption, but have decided to remain in that region for the present. For several days clouds of ashes fell. The snow fields for many leagues in all directions from Mount Redout are covered with ashes, and Montague Island, in Prince William Sound, is also covered.

Further advices are to the effect that explosions and rumblings are constantly heard, and earth tremblings are of frequent occurrence.

As Mount Redout stands in a wild and sparsely inhabited country, no serious loss of human life is feared, even should the mountain burst forth into active volcanic eruption. J. MAYNE BALTIMORE.

Barren Waters of the Adirondacks.

Editor POPULAR SCIENCE NEWS:

It may be a surprise to some people to tell them that there were large portions of the "Adirondack Waters" completely barren of all fish life; not even a minnow was found in them by the early settlers. Take the upper "Boquett valley," so-called, as an illustration; here we have a territory upwards of forty-five square miles in extent, well watered with beautiful living streams and lakes—the writer can remember the time when this whole tract was utterly barren of fish life.

Mark you, here were eight clear forest lakes, in some of them a depth of forty feet of water; also magnificent clear streams, one fourteen miles in length, and of a volume suitable to run mills and iron works. This region is situated in Essex Co., and comprises parts of the towns of Keene, Elizabethtown, and North Hudson. These clear forest lakes have smiled at the sun ever since the so-called glacial period, the crystal streams sang their songs to the beautiful forest trees, who can tell how long. All this time they were inhabited only by a few frogs and leeches.

The reason for the above state of things becomes evident, when we visit a place called Split Rock, where the Boquett river leaves this territory. Here we find an old "volcanic dyke," through which the river passes, falling nearly two hundred feet in a succession of cataracts, where the water is beaten in foam. A person can see at a glance, that it would be impossible for any fish to ever ascend these falls. In the pool at the foot and lower down stream were found plenty of speckled trout, also the pretty little South American trout, so-called, three varieties of suckers, also small minnows and eels. All these barren waters have been stocked, and at the present time there is fine fishing to be had in the proper season.

BAINBRIDGE BISHOP.

Questions & Answers

QUESTIONS NOT ANSWERED.

Answers are solicited, especially for all questions so far without replies. Questions will appear but twice, successively. The following questions need reply—366, 371-378, 383.

386. Hydrocarbons and Carbohydrates. What is the difference between these two things, or are they the same?

PETE ROLEUM.

387. Pink Clover. Is a pink clover, in size between red and white clover, only a variety of the latter, which often turns pink? G. J.

388. Robins. Do robins hear or see movements of worms beneath the surface of the ground, when they stand watching for worms? L. T. M.

389. Automobiles and Horses. Who has tried leading horses to an automobile, and moving the machine enough to make its peculiar noise? Nervous horses can be accustomed to anything, even a thundering railroad train. Usually horses need only to come close to an object and smell it, to overcome their fear. MECHANIC.

390. Peat for Fuel. There is plenty of it. Why not substitute it for high-priced coal, either as found or as compressed into something very like coal?

ANN THRACITE.

391. Stammering. What is the best cure for stammering? TUT.

392. Deafness. Can any of your readers give a remedy for slight senile deafness, or any instrument besides the old trumpet that will improve the hearing. I have heard there are such; if so, where can they be obtained? COLLINGWOOD.

393. Freckles. Perhaps some reader of POPULAR SCIENCE NEWS can give a remedy for the disfigurement known as freckles. What causes freckles to appear, and what is a good method of removing them?

395. The Malarial Microbe. Have any of your readers seen a description of this? Is it a bacterium, bacillus, or micrococcus?

JANET.

396. Canna Insect. What is the adult appearance of the insect that bores into the stem of cannas? The caterpillar found is about an inch in length, dark brown, with light dorsal line and light broad lateral stripe on the last four or five segments. The true legs and 4th, 5th, and 6th segments are dark. GARDENER.

397. Geranium Insect. Can any one of your readers name the caterpillar, slender, about 1¼ inches long, found eating a geranium leaf, and precisely imitating the stem of the leaf, as it stands out straight at an angle with the stem? GARDENER.

398. English Book Binding. Why is it that English cloth-bound books have the cover attached only by flimsy cheese-cloth or, still better, twine? The covers soon break off, and it is exasperating. With this I put another question: What is the sense of the recent fad of rough-edged book-leaves, as vexatious as uncut leaves?

READER.

399. Blackberries. Why is it that blackberries grow to perfection in size and pulpiness only in partial shade?

G. W. M.

400. Insects in Wet Seasons. Are the young larvæ drowned out in wet seasons? There is certainly a great reduction in numbers as compared with dry seasons?

OBSERVER.

401. Plantain Seeds. Who can beat this?—an average vigorous plantain (Plantago major) with 25 spikes, and 8,070 little pods, each of which contains "7 to 16 seeds?" Say eleven ovules, and it would be 88 770 seeds. No wonder this weed prevails. An inch was cut from an average spike, the pods (generally called seeds) counted, and multiplied by the 270 inches of spikes. OBSERVER.

402. Brilliancy of Sun. What is the cause of the greater brilliancy of the morning sunlight as compared with that of the evening? The sun's rays penetrate the same amount of atmosphere in ascending to the meridian, as in descending from meridian to horizon. The presence of dust, mist, or smoke will not explain it, since the light of morning in all circumstances seems keener, fresher, than that of evening which is more yellow and fire-like.

A. H.

ANSWERS.

380. New Cement. The plant for the manufacture of Edison's recently perfected cement is in operation, and is situated at Stewartsville, N. J. It is now stated that the cement is to be sold at 50 cents per barrel. H. P. BURT.

384. Mosquitoes and Germs. In reply to the enquiry of how the germs originate, I would say that I long have had a theory, it has been nearly proven now, but we will call it a theory still; that the germs originate in Protista, organisms placed between animals and vegetables, which are on the soil and water and are gotten by the mosquitoes on their feet, bodies, and stomachs also, thus carried to man and there deposited. How they originate I do not know and cannot be known at all. It is theory, of course. I have called them Proto monas.

A. M. E., M.D., F.L.S., F.R.M.S.

384. Mosquitoes and Germs. The germ of malaria is not originated by mosquitoes. It is a microscopic form ot life that has a remote ancestry, like all life. The subject, according to J. B. Smith, State Entomologist of New Jersey, needs much investigation still. There are many species of mosquitoes, each with its own habitat, some in the larval state in certain situations, others in other; and the haunts of the adult insect are more or less restricted also. That certain species contain the malaria microbe would hardly seem to be due to anything in their constitution that favors the multiplication of the microbe more than in other species; it is supposable, rather, that this abounds in the particular water where the larva lives. Yet, like many microscopic organisms, it is presumably diffused generally. Else why should excavation of the soil promote malaria by setting free the germs, as there seems to be good reason to believe?

MIKE ROE SCOPE.

385. Transplanting Trees. The established maxims are that decidious trees and shrubs should be transplanted when bare of leaves, and trimmed enough to counterbalance the considerable loss of far-reaching roots. Of course the more root in an unbroken ball of earth, the better. Trees of much size, with the tops cut back, have been successfully transplanted; and very large trees, trenched around in the Fall have been transported after the mass of earth froze so as to hold together.

It is a truism to say that the roots should not become dry in the process of removal; hence the "heeling in" by nurserymen, the dipping in mud, the bundling up in wet moss and straw. This precaution is especially necessary with plants of the pine family, which contain a resinous sap that is fatally thickened to gum by drying. A doctrine was that the transplanting is advisable when this sap is most thin, that is, when the evergreen begins to put forth fresh shoots. But fall transplanting is favored in regions where there is likely to be a drouth in late spring or early summer.

M. J.

385. Transplanting Trees. If the questioner means maples, I would advise to take them up carefully, protecting the roots from sun and air, cut and trim to a bean pole, then carefully set them out, setting them at the same points of the compass as found in the forest, pressing the dirt thoroughly among all the roots. The tree will surely live, and grow a beautiful and symmetrical top.

TIMOTHY WHEELER.

386. Hydrocarbons and Carbohydrates. The former term is applied to compounds that have only the elements in the name, hydrogen and carbon, such as petroleum and its many constituents or derivatives. The latter term, as its composition denotes, include compounds of carbon and the two elements, hydrogen and oxygen, these being usually in the proportion in which they exist in water. Such are starch, sugar and cellulose. It is a trifle unfortunate that hydro in the first, referring only to hydrogen, is so much like the termination of the second, which refers to water,—a reference which we know well in the term hydrant, the fire-plug in the streets.

CHEMIST.

387. Pink Clover. I hope someone will answer G. J.'s question. Here on Long Island, it comes under Gray's two stars, in his subdivision of Trifolium, but disagrees with the only description it approaches, the T. reflexum, Buffalo clover.

SUBURBAN.

388. Robins. It seems impossible that robins hear "movements of worms beneath the surface of the ground." The turning of the head, as we do in listening, may be only that the bird may see better, his eyes being in the side of the head. My observation is that he strikes for an angleworm only when it is so near the surface that he can instantly pull it forth. Besides, he seems to be watching for and seizing various surface insects, not alone for ground-worms.

F.

389. Automobiles and Horses. Your querist "Mechanic" happily got ahead of a movement, within a month past, to have arenas where horses can be brought to accustom them to automobiles, first the sight of these, then their slow motion, then fast motion and noise.

PHAETON.

392. Deafness. Twenty-third street, New York, east of Broadway, is the locality of optical and auditory goods. A search there revealed nothing in the way of improved ear trumpets, except a small contrivance, somewhat like a telephone receiver, with the ear-end closed and perforated with holes. It does not aid my hearing, save that it gives a curious loud barking effect to one particular note when a speaker strikes that note. It is worthless to me, though it cost several dollars. Contrivances to be inserted in the ear, out of sight, are advertised, but I have not faith enough to experiment with them. I paid a good fee to a specialist doctor to examine into the cause of my deafness and to prescribe, but no good resulted.

SENEX.

393. Freckles. I would say there is no "remedy"; it is the cause that should be removed. The cause is bad blood, and bad blood is caused by bad diet. A fruit and grain diet (vegetarian) will remove the freckles, and restore sleep.

TIMOTHY WHEELER.

394. Insomnia. Much appears in health journals on this subject, and many persons have their little tricks and methods to induce sleep. Very likely that which is successful in one case has no effect in another. One must keep in mind certain physiological principles,—first, to cultivate general health and so to restore the natural inclination to sleep; and, secondly, divert blood from the brain, sometimes by a light lunch that sends blood to the stomach, or exercise, or a bath that sends it to the limbs and general surface, or by dull reading that produces somnolence, instead of anything that rouses the mind and quickens cerebral circulation.

If there be circumstances that worry the mind, one can only endeavor to dismiss them by an effort of will, or by fixing the thoughts on something pleasant, perhaps by mentally humming some cheerful song or hymn. Abstinence from sleep in the daytime, along with active habits, will go far to prepare one for sleep.

DOCTOR.

Current Mention

Tricks with a Gas Jet.

Get a piece of glass tubing and heat it in the flame, then draw out the heated part until you have a tube as small as a pin. Break it off at its smallest part and you have a pinhole burner. Get a piece of rubber piping, which you must attach to an ordinary gas jet, the other end to the thick end of the glass tube. When the gas is forced through and lighted it will burn in a long, thin flame.

If the room is quite free from draughts and all present are silent, the flame will be steady, but if a watch is held near, it will wabble and flare back and forth, keeping exact time with the ticking of the watch. If you will call out in a loud voice it will leap to one side as though you had frightened it, and if you keep up a conversation in a loud voice it will dance about as though in excitement.

To make a gas jet speak, or to cause it to transmit sounds like a telephone, you must surround the pinhole burner with a tin tube having a small hole in one end, through which the burner projects a little way. The bottom of the tin tube must be made to connect with a speaking tube, which may be in another room or on another floor.

Speak into the tube, no matter how far away from the gas burner, and the sound has to escape through the hole through which the burner projects and is, therefore, forced against the base of the gas flame, which is always more sensitive. The flame will take up the wave sounds and magnify them so that the words can be heard all over a very large room, and if you attach a phonograph trumpet to the burner the sounds will be still more increased in strength and loudness.

To prove that it is really the gas that does the talking, turn off the gas and instantly the sounds cease, though the person at the other end of the speaking tube continues his conversation. If you force the gas through a square of wire mesh, very fine and raised above the burner, by holding a lighted match above the wire gauze the gas will burn only above it, making a conical flame. This, having a larger base than from an ordinary burner, is very sensitive. If you sing or play, whistle or talk on a level with this flame it will dance in perfect time and you can make it perform all sorts of antics by changing from whistling to singing, or from a funeral march to a two-step.—Sun.

A Curious Chinese Fish.

At one of the many creeks that make a network of the district round the mouths of the Canton river, and which forms the barbor of Macao, an odd fishing industry is carried on by the poorest class of Chinese. Like the other branches of the Canton river, this creek brings down an enormous amount of matter in suspension, which is gradually but surely filling up the harbor. At low water large expanses of mud flat are uncovered. There are miles of it, of a yellowish-brown tint, consisting of the soil of the country which the river traverses. With this is a considerable proportion of sewage and filth of all kinds from Canton or other large towns and villages, with that from the shipping, or rather boat population. This mud, by the way, is of marketable value, great quantities being dredged up by native mud-boats, and used at Macao and Hong Kong for cement-making.

These mud-flats are the home of a species of goby of the genus Boleopthalmus, very nearly allied to the co called walking-fish, Periopthalmus. They are, like the mud, of a yellowish-brown color, mottled with darker brown, and spotted with a few bright blue markings on the upper part of the body and dorsal and tail fins. These gobies, like their allies, are soft-skinned fish, with exceedingly small scales, and average about five inches in length. The eyes are very close together, and on the top of the head.

When the tide is out, these fish lie on the surface of the mud in vast numbers, sometimes taking a series of little jumps like a frog, and at others moving slowly by the aid of their fins, which they use like the flippers of a seal or walrus, so that they appear as if walking. When disturbed they burrow vertically into the mud. If in the water, they lie on the bottom, seldom rising much above it. They have a habit of raising and depressing the dorsal fins, especially when chasing one another. This goby is very fond of climbing on to a stone or mangrove stem, right out of the water, where it will stay for a considerable time.

Hundreds of Chinese men, women and children, catch these fish when the water is low. Some of these people simply wade in the mud, which takes them up to the knees. They are furnished with baskets, made with a wide mouth and narrow neck, strapped on their backs. Most of them use a sort of mud-sledge, which is merely a board four or five feet long and and a foot broad, slightly turned up at the front end, where a piece of wood or rough rail is provided as a hand-rest, or, to use a bicycling term, a handle-bar. On this sledge they rest with one knee, whilst with the other foot they propel themselves along the mud at a good pace, taking advantage of all the little depressions where there is an inch or two of water, and every now and then getting off the board and groping for the fish in the mud, with both hands up to the elbows.—Science Gossip.

CHINESE GOBY.

Table of Ores of Economic Importance.

Mineral Resources of the United States, 1901. United States Geological Survey, contains a table of ores of economic importance, showing percentage of metal contained, by Dr. Edmund O. Hovey. This table has been compiled from several authoritative sources, the ores under each metal being arranged in the order of mineral species given in Dana's System of Mineralogy, sixth edition. In a mining region, says Dr. Hovey, one often hears ores spoken of as running 90 per cent. lead, 80 per cent. zinc, and so on, when the purest crystallized minerals do not contain such amounts of the metals. One column of the table shows the highest possible percentage of metal in the various ores, and another column indicates the corresponding amounts of metal in the short ton (2,000 pounds) of pure ore.

Inheritance of Color in Pointer Dogs.

Sir Francis Galton proposed in 1889 a statistical law of heredity applicable to bisexual descent Briefly stated, it was that one-half of the offspring's characteristics are derived from the parents (an equal amount from each), one-fourth from the grandparents, one-eighth from the great grandparents, one-sixteenth from the great-great-grandparents and so on. In 1897 Galton tested the hypothesis by the consideration of a single color characteristic—the condition of being tricolor or non-tricolor—in Bassett hounds. The work has lately been repeated with data obtained from the American Kennel Club stud books by F. E. Lutz and E. B. Meek. The dogs considered were 300 pointer dogs, of which 600 parents, 1,367 grandparents, 1,361 great-grandparents and 978 great-great-grandparents were known. The results showed an almost perfect harmony in each instance between the facts and Galton's hypothesis, the greatest real deviation being only 1.1 per cent.

BOOK NOTICES.

The Home Aquarium, and How to Care for It. A guide to its fishes, other animals and plants; with many illustrations. By Eugene Smith. Pp. 213. E. P. Dutton & Co., New York. $1.20, net. An interesting and useful work, the author giving the fullest directions as to the construction of the aquarium, which is always a source of pleasure and instruction in the home. Those who contemplate the establishment of an aquarium, as well as those who need a handbook, will find this work valuable.

The Book of Orchids. Handbooks of Practical Gardening VIII. By W. H. White, F.R.H.S. Edited by Harry Roberts. John Lane, London and New York. 1902. Pp. 118. With eleven full-page illustrations. While forty or fifty years ago orchids were almost unknown in this country, widespread attention is now given to this peculiar member of the vegetable kingdom. Mr. White, having had such wide experience at orchid growing in England, is able to give most excellent advice and reliable directions for growing, which he does in this excellent little book. The excellence of the illustrations and the good quality of the paper on which it is printed adds to its charm.

Meteorite Studies. I. Geological Series, Vol. I to II. By O C. Farrington, Ph.D., Curator, Department of Geology, Field Columbian Museum, Chicago. Four full-page plates and six text figures; pp. 32. Fully describes various meteorites in the possession of the museum, giving composition, locality in which found, and other data of extreme interest to mineralogists.

A Contribution to the Ichthyology of Mexico. Vol. III, No. 6. Pp. 64. By S. E. Meek, Assistant Curator of Department, Field Columbian Museum. Based on a collection of fishes made in Mexico during April, May and June, 1901. The more important river systems were examined, chiefly with the view of discovering the southern range of our North American ichthia fauna, and the northern range of the South and Central American faunas. Eighteen finely executed plates.

"Wireless." The latest thing in science always interests Rudyard Kipling. His story in the Fiction Number of Scribner's has for its setting a house on the Coast of England where Marconi experiments are taking place on a cold winter night, and they are listening to the battleships of England talking back and forth through the air along the Channel.

Strange Story of a Monkey's Paw. A dried monkey's paw, a talisman, is the pivot upon which turns the plot of a weird and unusual story in Harper's Magazine for September—"The Monkey's Paw," by W. W. Jacobs. Mr. Jacobs is best known by his humorous stories of English seafaring folk.

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Variability of Solar Radiation.

It would seem at first sight a simple thing to show whether the sun radiates more at one time than at another by a direct exposure of a suitable actinometer during a term of years. This has been done in several instances, but so far as I know with a wholly unconvincing result. While large fluctuations in the curve are evident, any connection between them and the 11-year sun-spot period, whose maxima occurred in 1883 and 1894, is hard to recognize. The observer at the earth's surface sees the sun much as a fish at the bottom of the lake sees the clouds. More than one-half of the sun's radiation which reaches the outer layers of the earth's atmosphere is reflected or reradiated away or is absorbed within the atmosphere, and fails wholly to reach the earth's surface, except as heat produced by absorption, and communicated chiefly by convection and precipitation. The atmosphere is constantly varying in its transparency. These changes are chiefly caused by water vapor, water globules, and dust becoming more or less abundant, and are so great that even the largest depressions in the curve of actinometer results might easily be thus caused. Recent unpublished spectrobolometric studies at the Astrophysical Observatory show that on two apparently equally clear days, near the middle of March, 1902, with equal altitudes of the sun, the difference in the absorption in the well-known visible and infra red water-vapor bands alone was such as to cause a difference in the solar radiation at the earth's surface of 7%. Changes far in excess of this occur from the same cause between spring and summer.

Without speaking too confidently in a matter of such difficulty, I am inclined to think that regions of the solar spectrum exist whose transmissibility in the atmosphere may be closely determined and in which spectral actinometry may be carried on, even at the earth's surface, in such a way as will determine satisfactorily whether the emission of the sun has an 11-year period or not. It may be of interest to add that spectrobolometric observations of this kind are now in progress at the Smithsonian Astrophysical Observatory.

These new views then, like all their predecessors, point to the complexity of the sun, and the uncertainty of deductions based on our present knowledge. At the same time the probability of a vital connection between the solar changes and matters of great interest upon the earth has been more and more confirmed within the last thirty years.—C. G. Abbot, Monthly Weather Review.

Readers of POPULAR SCIENCE are requested to mention that paper in corresponding with Advertisers.

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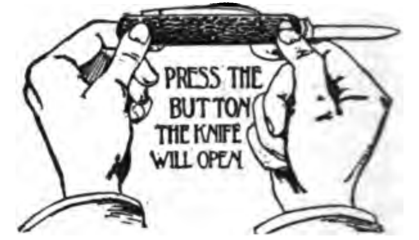

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Automobiles in the Desert.

Sir Rudolf Slatin, on his way from Cairo to London recently, passed through Vienna, and was there interviewed on the prospects in the Soudan. What he said is commented on at length by the semi-official Austrian organ, particularly the part of the interview dealing with the introduction of motor cars. Sir Rudolf said in part:

Vast tracts of fertile country and mineral lands are now comparatively valueless because no facilities exist for bringing the products to a market. I believe that the introduction of automobiles would prove highly beneficial. Many parts of the country are already perfectly adapted to such traffic, and where it is necessary roads could be made without great expense. Automobiles, strongly built, and capable of carrying goods in fairly large quantities, would afford an excellent substitute for railrays at a fraction of cost of the latter. Machines with a high rate of speed would not be required—strength and capacity being the chief essentials.

◆

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The newest locomotive is the New York Central Co.'s new tandem compound, No. 2399, recently built at the Schenectady Locomotive Works. It has taken 108 loaded cars from De Witt to Albany in eleven hours. The cars were loaded with 4,500 tons of freight. The increased power of this locomotive is gained by the use of steam four times, one compound cylinder placed ahead of the other, hence the name, "tandem compound."

◆

Nile Dam Finished.

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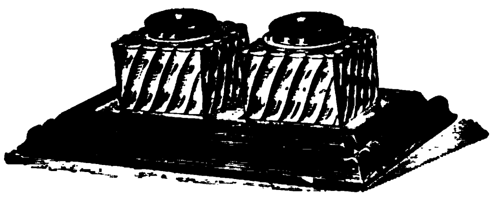

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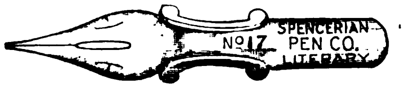

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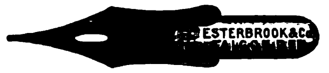

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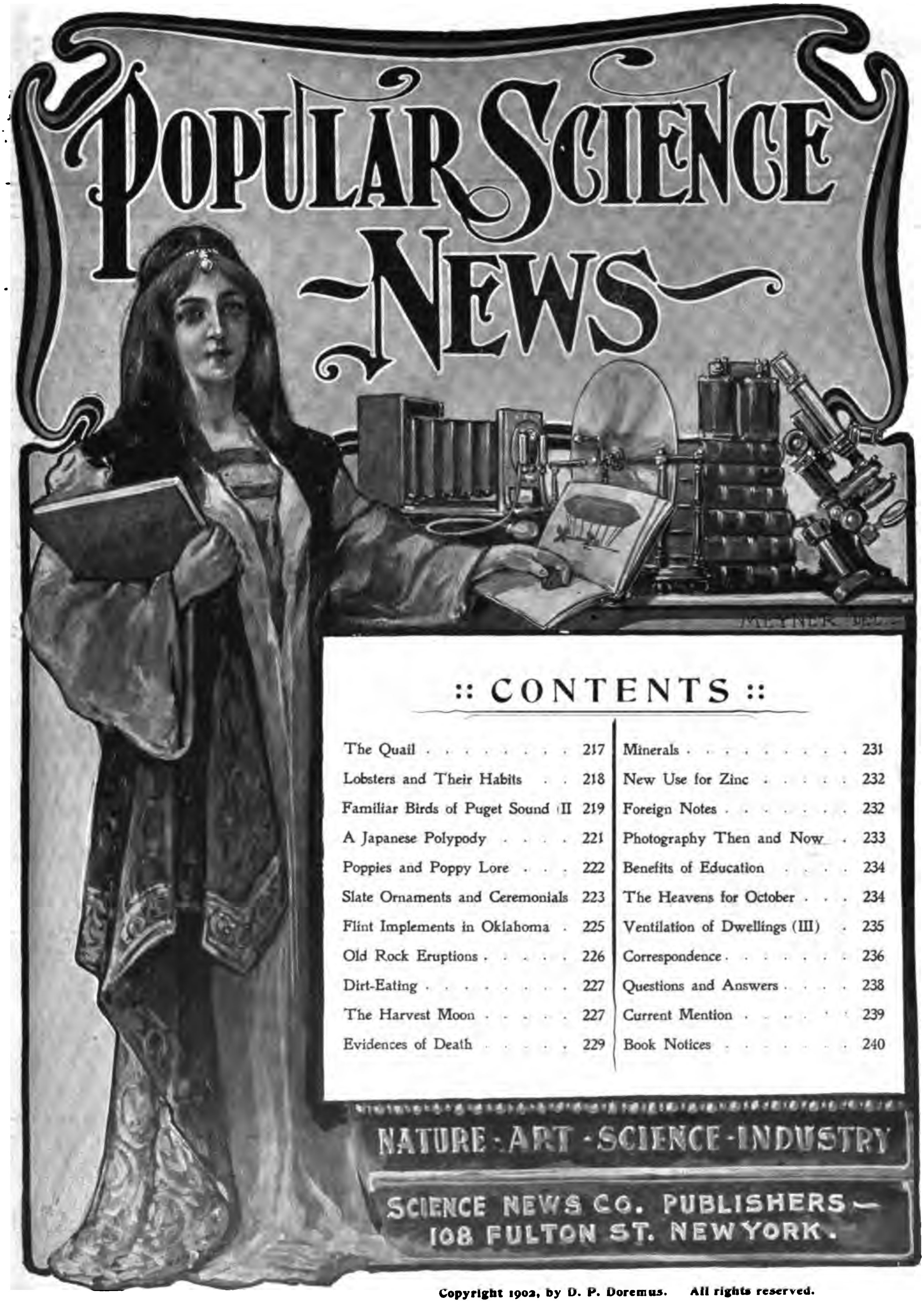

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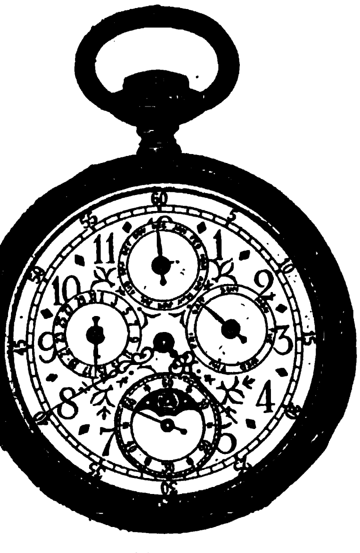

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THE QUAIL

By BESSIE L. PUTNAM.

FOR obvious reasons "quail on toast," as strictly an American dish as the Thanksgiving turkey, no longer satiates the taste of the Epicurean save on rare occasions. Not that he has grown more fastidious in his desires. Oh, no! But a shortage of the supply, together with a growing recognition of the quail's economic importance, has led to more stringent legislation, which in many localities has come none too soon.

The quail, or "Bob White," as it is usually known, is the most prolific, and the most widely distributed by nature, of our game birds. It chooses open fields adjoining some small thicket, whither it can seek refuge from attack, and is indigenous in such locations throughout the United States east of the Mississippi and Missouri, excepting in Northern Maine and Florida, the Florida Bob White, a smaller and darker colored species replacing it in the latter state. It is also found in Louisiana, Texas, Indian Territory, Missouri. Kansas, and Nebraska; further, it has proved by actual experiment capable of adapting itself to almost every state and territory in the Union. And with stringent game laws its prolific nature would soon render it a familiar resident; and old haunts now silent would once again resound to its cheery note.

One of the first laws enacted for its protection was that of New York in 1791, imposing a penalty of 20s. for killing quail on Long Island or the city and county of New York. Six states now give complete protection to the quail. In five of these it has been recently introduced; Wisconsin, where it was almost annihilated by ruthless hunting, is now striving to make amends for past neglect by total protection. Forty other states and territories protect save during a stipulated period, which averages from two to four months of the year. Killing for sale is strictly prohibited by a number of states. Others aim to restrict by requiring hunters to secure license, and by limiting the amount of game that may be bagged in a day.

This last provision, however, in the case of the quail seems but a nominal protection; for the number is in several instances extended to 20 or 25 in one day. About forty states prohibit its export to other states,—though a number of these make exceptions when birds are desired for propagation. While in certain sections the protection is still inadequate, the situation is more hopeful than ever before. And the general arousing to the necessity of concerted action bespeaks the initiation of a movement which shall become as universal as efficient.

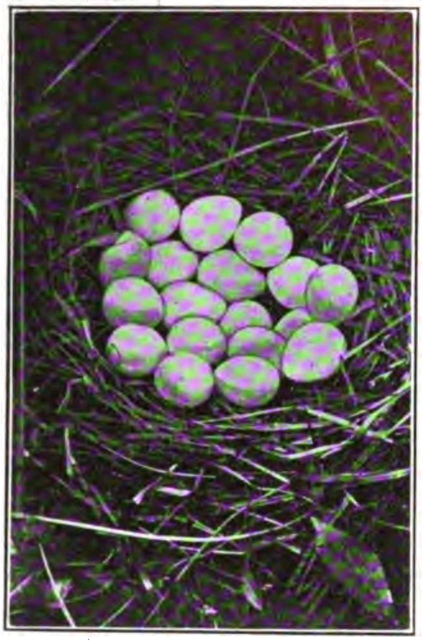
It is one of the smaller game birds, being about as long as a robin, but more plump. The "whole flock of young turkeys" reported by some little folks as seen on an autumn day gives a very good impression of their appearance. The color of the male is brownish on the back, throat almost white, and breast barred with black. The female is similar save that the throat is buff, and the black markings on the breast are less conspicuous, or absent

In middle latitudes housekeeping begins in May or early June; and one of the pleasantest features of quail life is the conjugal happiness and equality manifested. The male shares the labor of nest building; and if any disaster befall his mate, he cheerfully and faithfully assumes the maternal duties by sitting upon the eggs and rearing the brood.

The nest is simply a small cavity in the ground, filled in with dried grass or similar material, and usually placed under a protecting arch of weeds or vines. The entrance is on one side. Tall meadow grass is not infrequently chosen as a nesting site, and the mowing machine proves too often a destructive agent.

The eggs vary in form from round ovate to subpyriform, and are of a dull white, slightly glossy, and unusually strong and thick-shelled, considering their size. From

12 to 18 eggs are deposited before incubation commences. A standard authority states that he has found as many as 37 eggs in a single nest, doubtless the joint product of two or three quails. These were neatly and regularly arranged in tiers, with the smaller end of each egg pointing downward. In the Middle States, where two or three broods are raised in a season, the clutches are smaller than farther north, where but a single brood is attempted. The period of incubation lasts 24 days. It has been stated that if disturbed before completing the entire clutch, they desert; but after incubation has commenced they will remain. The last part of this rule does not always hold good. The writer recalls a nest disturbed by the mower; and though the eggs were almost ready to hatch, and those not broken were at once restored, the old birds refused to return.



QUAIL'S NEST AND EGGS

The newly hatched birds are at once prepared to leave the nest. If surprised, the old bird at once feigns lameness, fluttering about, seemingly within reach of the intruder, yet always just eluding any attempt at capture. Obeying the maternal warning, the little ones at once hide in the weeds or grass, and when the old bird has withdrawn the invader to a safe distance from her brood, her crippled fluttering is suddenly transformed into a strong, well aimed flight.

It is stated that while she is hatching her second clutch, her mate takes charge of the first brood, and in autumn the entire family may be seen most happily reunited, and subsisting on various seeds, grain, acorns, etc.

"It was autumn, and incessant
Piped the quails from shocks and sheaves."

This realistic picture is given by Longfellow; and most miserly is he who would not willingly accord to these beautiful gleaners the grain left in the stubble. Early in the season the young feed almost exclusively on insects. The quail is fond of the moth which produces the cut-worm, and is one of the very few birds which will devour the potato beetle. Hence its services in subduing these two pests are worth many times the grain that it consumes.

The parental pride of the quail in the vocal attainments of its offspring was thus forcibly impressed upon the writer in a way as amusing as interesting. On riding past a thicket one day, we were greeted by the clear, bell-like notes of "Bob White." "Bob Wite" came in a thin, cracked voice from the other end of the lot. Clearer, more distinctly, was repeated the call of the instructor, yet the echo was little better than before. Again and again was the lesson repeated, patience and precision on the one side being supplemented by persistence and earnest endeavor on the other. But as we slowly drove out of hearing the musical enunciation of the parent and the comical Anglicism of the little one, who persisted in omitting the sound of "h" from his "White," kept ringing in our ears.

Heavy snows often prove very disastrous, burying entire flocks; and if, as frequently happens, a crust of ice ultimately covers it, they are caught as in an avalanche, from which they never emerge. When the snow is so deep as to cover their seed supply, they frequently resort to the orchard, nibbling at stray frozen apples that may be left clinging to the tree.

At such times they are also frequent visitants in the farmyard, and if grain is thrown out they soon learn to await feeding time with as much precision as domestic animals, eating like young fowls. If a sudden movement is made, however, they take wing as if by preconcerted action, to return in obedience to the promptings of hunger. So tame do they sometimes become that more than one farmer has been deluded into the idea that they were really domesticated. But with the return of genial weather they invariably return to their wild life.

"Dark Light."

Some five years ago M. Le Bon announced that when light fell on one side of certain bodies—a thin metal plate, for instance—the other, unilluminated side of the plate gave out non-luminous radiations, which were later shown to be identical with cathode rays and which are now believed to be made up of elements of atoms carrying an electric charge. The radiations are analogous to the X-rays and to the rays of radium, and traverse thin plates of metal freely and discharge electrified bodies in their path. Similar effluvia are produced in a great number of chemical reactions, and the phenomenon is, in fact, one of the most common in nature.

Animal Life

LOBSTERS AND THEIR HABITS.

BY J. R. NICHOLLS KYLE.

Facts concerning the physiology and habits of lobsters form a very recent contribution to natural history. These creatures, in spite of the exquisite vermilion hues with which they are tinted, by boiling, are among the ugliest found in the aquatic world. Pause to examine one for a moment. Its head, with the four feelers close to its eyes, is joined to its body by an enormous throat from which project ten arms, the two front ones bearing such huge claws that their weight amounts to one quarter, sometimes one-half of the entire avoirdupois of the animal. Its abdomen is provided with a number of swimmerets, or hair-like filaments, the anterior portion in the female ending in a broad, paddle shaped tail, while the whole body is covered with an exceedingly hard shell, which, nevertheless, is perforated with minute pores through which sensation is conveyed.

The average length of a full grown female measures from eight to twelve inches, though in some isolated cases a length of fifteen and even twenty inches is attained. Their average weight is twenty-five pounds; the largest specimen on record, captured off Sandy Hook, in 1897, having weighed thirty-five pounds. The peculiar substance with which the eggs are coated assumes, after contact with the water, the quality of adhesive glue and fastens them tight to the animal's swimmerets, on which they are carried for ten or eleven months, their condition being denominated as "berried lobsters." When they hatch the young leave their mother entirely, to enter upon an independent existence. In fact, the waving of her swimmerets serves to drive them from her side, as testified by those who have witnessed the hatching process. Precarious indeed is the life of lobster fry! As soon as it is born it sheds its en-entire cuticle as well as the lining of its digestive apparatus, an operation which costs the life of myriads of the species. Those that survive manifest a decided love for sunshine, coming from their nocturnal retreat in shallow waters to bask in its rays all day at the surface.

At the end of about five days it is required to submit to the process of molting again, and at the end of five more it casts off its integument for the third time. During the first three or four months it molts ten times, the operation becoming less frequent with age; until, with adults, molting occurs only once in two years, as several months are required for the hardening of each new shell. As freshly-laid eggs are seldom found on a soft-shell lobster, the reason why spawning takes place but once in two years is readily explained. When five years old a lobster has reached maturity, and has cast its shell about twenty-five times. The reason for this phenomenon of molting is easily found in the fact that each new shell, being composed of a dead substance excreted by the skin, admits of no increase in size and has to be discarded by the growing animal.

At the end of the fourth molt, fry lose their swimming organs but still remain at the surface of the water, propelling themselves forward by means of their tiny swimmerets. At this time their eyes are enormous. When the next molt occurs swimming is abandoned and the tiny, but full formed lobster goes to the sea bottom, there to spend the balance of its existence.

From life, by A. H. Verrill. LOBSTER (HOMARUS AMERICANUS).

Assuming at once the habits of an adult, it hides itself among piles of stones near the shore, coming forth only by stealth in search of food. Sometimes its place of refuge is an empty conch shell, in which it bids defiance to the entire host of predacious fish.

So numerous are its cannibal enemies that it is safe to estimate the survivals from their destruction at two out of every ten thousand hatched. A very funny trait of young lobsters is their "shamming death." Whether the involuntary effect is fear, or a state of catalepsy, has not been decided, but often when annoyed by a stick or an investigating hand, they will roll over, straighten out and lie still with their limbs as stiff as if paralyzed.

On the sea bottom the lobster is perfectly at home, for buoyed up by his native element, and assisted by the waving of his swimmerets, he no longer feels the oppressive weight of his body and huge claws, but moves about on his slender legs in a very lively manner, devouring all the dead fish he finds and, when disappointed in his scavenger labors, hiding himself in a rocky crevice or a bunch of seaweed till some unlucky victim, such as a flounder, a crab, or a clam, comes within reach, when he deals it a deadly blow with his club-claw, and, seizing it with his pincer-shaped one, holds it fast while he dines upon it at leisure.

The eyesight and hearing of lobsters are both very dull, but these deficiencies are more than compensated by their extreme wariness. No matter how hungry he may be, the creature will crawl round and round about a trap examining it with the utmost suspicion, till the bait becomes so tempting as to conquer his timidity. In winter he burrows in the mud, digging the hole with his tail and, when interrupted in his work by an occasional stone, lifting it out with his claw. As many as five lobsters have been found in a single hibernating bed; and it is amusing to see them, when thus surprised, throw themselves into an attitude of defense like a human boxer, and strike out savagely with their powerful claws.

One of their most extraordinary feats is that of shooting backward through the water. The ancient writer, Pliny, denominates lobsters as locustæ (locusts of the sea), because they could spring out of sight, tail-foremost, in an instant. Another means of self-defense which they possess is that curious power of detaching one leg at pleasure, leaving the member behind in the hands of the outwitted fisherman. They also have the faculty of reproducing these lost limbs, the rapidity of their regeneration depending, like the growth of plants, upon temperature. Under favorable conditions new legs will sprout in three weeks, while, if broken off in winter, they will not grow agian till spring.

"Berried lobsters" are considered a great delicacy for the table, their spawn contributing to make a very rich sauce. The consequent wholesale improvident slaughter of egg-bearing lobsters has caused the U. S. Fish Commission to give special attention to their artificial propagation, lest the species be exterminated. By present methods a large number of females are captured each year, and their spawn stripped off their swimmerets with a dull knife. The creatures are then liberated, while the eggs are placed in glass jars through which a current of fresh water is caused to flow continuously by artificial means. The period of incubation depends upon the age of the eggs when collected. To give a small idea of the gigantic plan on which this work is conducted by our government, I need only mention that as many as 150,000,000 were taken in a single year, ninety per cent. of which hatched. So marked is the cannibalistic tendency of lobster fry when reared in captivity, that it has been found advisable to liberate them, as soon as possible after hatching, either in the vicinity of the grounds from which the adults were taken, or to transport them to new localities.

The geographic distribution of the lobster on this continent is from Labrador to Delaware, a few stragglers being found on the coasts of North Carolina and Virginia. In the United States they are most numerous on the coast of Maine, while a queer variety known as the "spiny lobster," from a prominent spinous process on its back, is found on the Pacific coast. This species has no claws, like those of the eastern species.

FAMILIAR BIRDS OF PUGET SOUND.

BY CARRIE H. GARRETSON.

II.

Soon after the meadow larks begin their spring songs, the rusty song sparrows (Melospiza melodia morphua) will sing nearly all day when the sun shines; if it rains, their wings droop and they look bedraggled and forlorn, and only chirp in a fretful way occasionally. Robins chirp and sing if the weather is not too disagreeable, and at sunset pour forth the sweet, tender notes of their even-songs from the tops of the young evergreens. The flicker's loud "yarup" is also heard, soon followed by his hammering on the dead limb of a tree and his rapidly repeatedly call of "quick, quick, quick," which sounds as if he wished to awaken all nature and hasten the arrival of spring birds and flowers. Our flicker or red-shafted woodpecker (Colaptes cafer collaris) is another noticeable western variety—flashes of red instead of yellow being visible beneath its wings and tail as the bird flies, and the patch on the cheek is red instead of black.

Gairdner's woodpecker (Dryobates pubescens gairdnerii) the western "Downy" occasionally visits the trees about the house, but is not as much at home yet as the flickers. As if in response to the flicker's call, the crows (Corvus Americanus), that gossip around the ash-heaps, begin to caw as they fly past; the flock of Brewer's blackbirds (Scolecophagus cyanocephalus), on the roofs, fill the air with their curious crackling and snapping notes; and the red-winged blackbird (Agelaius phoeniceus), in the rushes by the lakes, "flutes his O-ka-lee." While in the gulches where the sun shines in the morning, the skunk-cabbages push their yellow hoods through the rich black mud, the pussy-willows shake off their brown winter coats, there is a delightful medley of bird-music that is quite distracting to one who attempts to discern what songsters are contributing to the concert. The songs of Vigors's wren (Thryomanes bewickii calophonus) and the song sparrows are heard at intervals, clear and sweet above the incessant twittering and chirping.

The golden and ruby-crowned kinglets (Regulus satrapa olivaceus and R. calendula) keep repeating their monotonous but sweet little songs, as they search the branches of the alders and young evergreens for insects; and if they chance to come near where you stand, they will pause a moment in surprise, look at you with their big, dark eyes, raise their pretty crests, as if in salute, and dash headlong into another tree. The jingling trill of the juncoes is frequently heard, and the oft-repeated "chick-a-dee-dee dee-dee" betrays the Oregon chickadees (Parus atricapillus occidentalis) perched on the stalks of the thimble-berry bushes, picking at the insect-galls, or carefully examining the crevices in the bark of an old fir tree. Occasionally the harsh scream of a jay is heard, the robins scold and chirp as they chase each other about, and the winter wren (Anorthura hiemalis pacifica) scolds in the sauciest way, as it watches you curiously from a stump or clump of brambles. Perhaps a flock of pine siskins (Spinus pinus) will rush down the gulch like a visible gust of wind, alight in the top of a big alder with a busy little flutter, and begin picking out the seeds—assuming all sorts of attitudes as they do so, some even hanging upside down on the bunches of cones. Although not a single bunch seems to escape them, they rapidly descend to the lowest branches, while the wings of the seeds fall in showers, and then with a twitter and a sudden swirl, the whole flock fly away to another tree.

The beautiful cedar waxwings (Ampelis cedrorum) pay us a visit during the spring sometimes as early as February, and then disappear until summer, when the young birds are with them; fluffy little creatures with mottled breasts, whose diminutive tails are nearly covered by the yellow band which characterizes the species.

As soon as the flowering currant (Ribes sanguineum) blooms, the lovely rufous humming birds (Selasphorus rufus) appear: bright little aerial gems which dart here and there or poise before the drooping clusters of coral blossoms to sip the nectar. The tiny body of the male is a beautiful golden brown and the head the metallic green so common among hummers, but the wonderful display of colors on the throat and upper part of the breast is indescribable. Appearing jet black in the shade, it flashes with the most gorgeous shades of red, gold, copper, metallic green and deep orange when turned to the light; sometimes it is golden on one side and bright scarlet on the other, and the colors blend and change from one to the other like an opal, as the bird darts among the flowers, or sits on a twig, incessantly turning its head from side to side, as if conscious of the charming effect. Suddenly there is a queer angry chirp, and you see a bright red flame in the air, which changes to a flash of pure golden light the same instant, as the bird dashes after a bumble-bee that persists in having its share of the honey. The female has a greenish back and lacks the brilliant colors of her mate. All summer they hover around the roses and honeysuckle, and sometimes build their exquisite little nest, so daintily decorated with lichens, in a crotch of a climbing rose or in the clematis about the veranda.

April is a merry month, the white-crowned sparrows (Zonotrichia leucophrys nuttalli) are here, and sing untiringly from morning until night—and from night until morning, too, for they have a restless habit of singing the whole, or a part of their sweet song several times during the night, even when there is no moon. In the shelter of the willows, where the tender, yellowish-green of the young leaves in the sunlight so nearly matches their own color, the yellow and lutescent warblers (Dendroica aestiva and Helminthophila celata lutescens) trill almost as incessantly as the white crowned sparrows sing. The beautiful violet-green swallows (Tachycineta thalassina) arrive, followed later by the barn swallows (Hirundo erythrogaster). And the purple finches (Carpodacus purpureus californicus) warble so sweetly all day long. The fruit growers, however, do not appreciate these sweet, pretty birds, because they nip off the cherry blossoms close to the stem and drop them on the ground. It does appear exasperating, but nature seems to have provided for them, as the trees are shrouded in blossoms, and when the cherries are ripe the branches droop heavily with their luscious burdens. The robins then take possession of the tress and help themselves so freely that people consider them a nuisance too, and some kill the birds and destroy their nests, in spite of a law to protect them. But no doubt they eat enough worms and other fruit pests to more than compensate for the berries they take, and surely, "the laborer is worthy of his reward."

May brings the pretty willow goldfinch (Astragalinus tristis salicarnans) which is almost identical with the American goldfinch. Various warblers, conspicuous among them the myrtle warbler (Dendroica coronata) and its western representative, Audubon's warbler (Dendroica auduboni), are seen on their way to the "prairies" where they spend the summer in the evergreens. There they flutter in pretty flocks about the trees, snapping their bills at unwary insects and the black-and-white butterflies so common among the young fir trees. The sweet song of the russet-backed thrush (Hylocichla ustulata) is heard; and the snowbirds, white-crowned sparrows, bluebirds and robins all bring their hungry broods to the lawn for crumbs and worms.

By the first of June from the tip-top of the maples come the songs of the warbling vireos (Vireo gilvus) so out of proportion to the dainty bird's diminutive size. And as soon as it is dark the night hawks (Chordeiles virginianus henryi) begin their nocturnal wanderings in the air, uttering their weird cries, which, as the shadowy forms circle about in the twilight or drop suddenly to the ground, give one the uncanny feeling that they are disconsolate spirits in search of something which they seem doomed never to find. Sometimes a sharp-shinned hawk (Accipiter velox) will cause a good deal of terror and excitement among the birds until driven away by the valiant swallows; and occasionally an eagle is seen circling about high over head.

All summer along the beaches the king fisher's (Ceryle alcyon) heavy rattle is heard as the birds fly from their nest-holes in the high clay banks to the trees overhanging the water, where they can watch for the fish they are so dexterous in catching. Crows feast on mussels at low tide, often in company with the sea gulls; and ducks float about in groups of two or three, or large flocks swim by with manoeuvres as precise as a well organized military company. The black-throated divers (Colymbus pacificus) disappear in the blue waters of the Sound, and are gone so long you almost despair of ever seeing them again, when up they bob here and there over the surface, only to vanish again in the same mysterious way. In shallow, secluded bays the beautiful blue herons (Ardea herodias) stalk about on their long legs, or stand on one, apparently lost in meditation; while everywhere are the sea-gulls floating through the air without the least effort, circling around the steamers as they puff along and skimming low over the water to catch the bread thrown to them, drifting lazily with the tide, or busy feeding the young gulls, sunning themselves on the beach.

The Oregon vesper sparrows (Pooecetes gramineus affinis) sometimes visit us for a while in the autumn· the pine siskins return and eat the dandelion seeds and pick the aphides off the rose-bushes; the hawking of wild geese is heard at night; and as the rainy season steals upon us, the voices of our home birds are hushed.

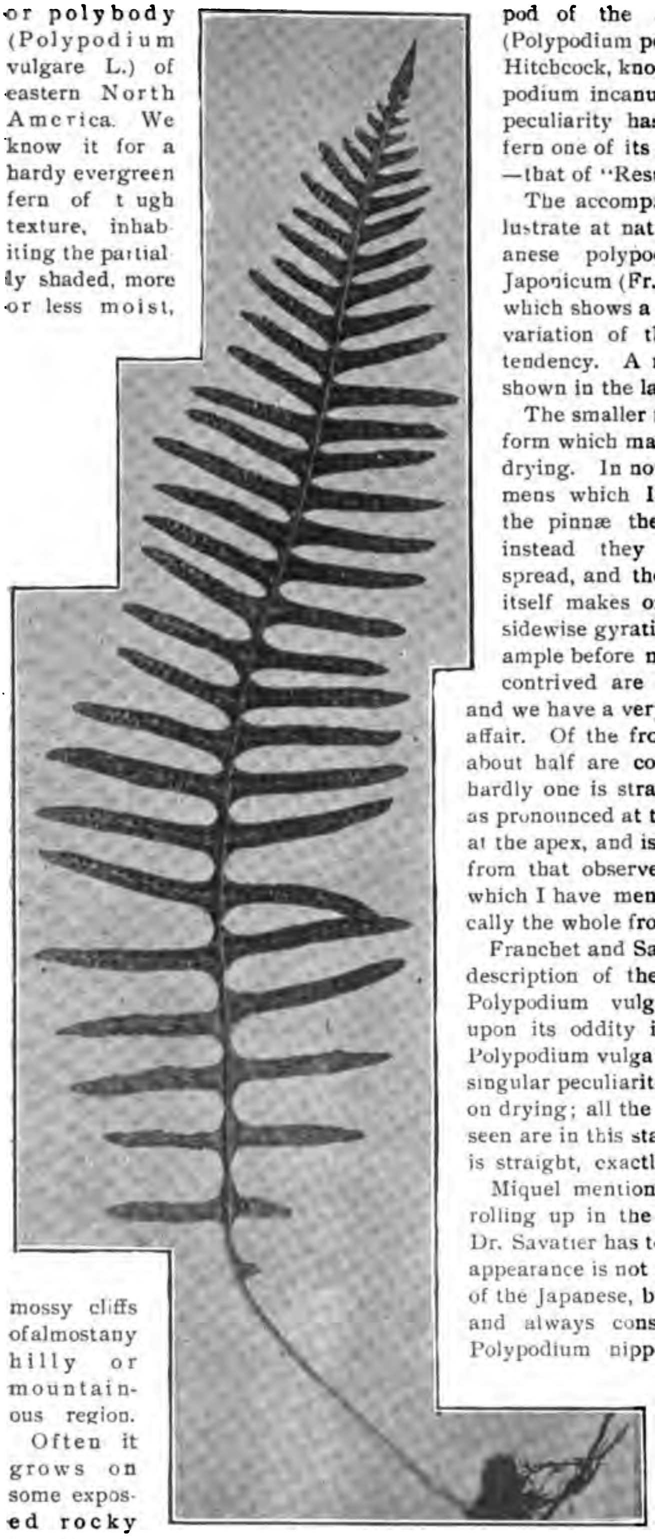
Nature's Skill.

One of the scientists who superintended the work of making the model of the extinct dinosaur for the Buffalo Exposition, said that considerable difficulty was anticipated in sustaining the huge armored skull in its proper position. But when the attempt was made, there was no difficulty at all. The lines of nature were carefully followed in making the model, and it was found that the parts about the junction of the head with the neck had been so nicely balanced, that a single pin at the base of the skull was sufficient to carry it.

Plant Life

A JAPANESE POLOPODY.

BY WILLIAM R. MAXON.



POLYPODIUM JAPONICUM (MAXON).

Almost every one who has any knowledge of ferns is tolerably familiar with the common polypod or polybody (Polypodium vulgare L.) of eastern North America. We know it for a hardy evergreen fern of tough texture, inhabiting the partially shaded, more or less moist, mossy cliffs of almost any hilly or mountainous region. Often it grows on some exposed rocky headland; and in such places in dry seasons, or in almost any situation in early spring, a good deal of it may be found with the pinnæ rolled up and the frond itself rolled from its tip part down to the base. Similarly during the "dry season" Polypodium plumula, and several other species of our American subtropical and tropical regions, roll tightly upon themselves only to again uncurl and become quite turgid upon the advent of the revivifying rains. The phenomenon is not uncommon. Indeed, in one other species, the common gray polypod of the southern states (Polypodium polypodioides (L.) Hitchcock, known also as Polypodium incanum Swartz), this peculiarity has given to the fern one of its common names, —that of "Resurrection Fern."

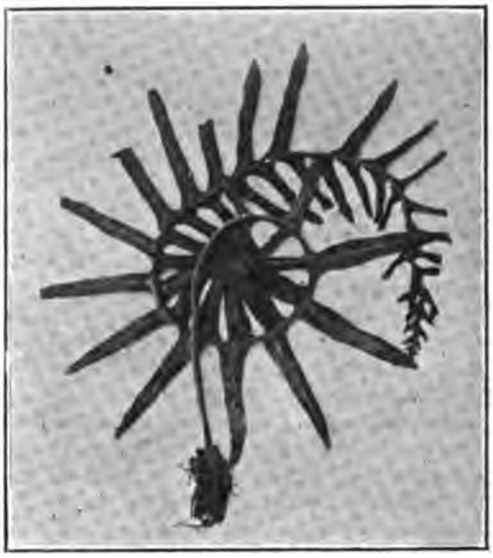
The accompanying prints illustrate at natural size a Japanese polypod, Polypodium Japonicum (Fr. & Sav. Maxon), which shows a most interesting variation of this well-marked tendency. A normal frond is shown in the larger figure.

The smaller figure shows the form which many assume upon drying. In none of the specimens which I have seen are the pinnæ themselves rolled; instead they remain widespread, and the rachis or stalk itself makes one or even two sidewise gyrations. In one example before me the two circles thus contrived are essentially concentric, and we have a very curious wheel shaped affair. Of the fronds which I have seen, about half are considerably bowed, and hardly one is straight. The curvature is as pronounced at the base of the stipe as at the apex, and is thus of a different sort from that observed in the other species which I have mentioned in which practically the whole frond rolls upon itself.

Franchet and Savatier in their original description of the fern (as a variety of Polypodium vulgare), thus commented upon its oddity in this respect: "The Polypodium vulgare presents in Japan the singular peculiarity of rolling upon itself on drying; all the dry specimens we have seen are in this state, but the living plant is straight, exactly like that of Europe.

Miquel mentions also the fact of this rolling up in the case of P. nipponicum. Dr. Savatier has testified that the unusual appearance is not due to any contrivance of the Japanese, but is the result—natural and always constant—of the drying. Polypodium nipponicum, I have never seen, but I take this "loop the loops" tendency in P. Japonicum to be due perhaps to quite a different set of causes from those bringing about similar results in the other polpyodies. If any of the readers of this journal have botanical correspondents in Japan, I think they would find it quite worth their while to secure roots of this interesting plant and to undertake experiments looking to a solution of the puzzle. The curvature is undoubtedly due to an unequal contraction in drying of the fibro-vascular system of the stipe; but why should the pinnæ always remain flat?

It is to be hoped that an explanation of this peculiar habit may be given.



FORM ASSUMED WHEN DRY.

Mimetic Fungi.

The Rev. A. S. Wilson contributes to Knowledge an article on Vegetable Mimicry, in which he says: Odd resemblances to various objects, which can only be regarded as accidental coincidences, are presented by a number of fungi. There is the Jew's ear fungus, which grows on stumps of the elder, and is so named from its unmistakable likeness to a human ear. The Geasters are curiously like starfish; Aseröe has an extraordinary resemblance both in form and color to a sea-anemone; equally remarkable is the likeness to a bird's nest seen in species of Crucibulum, Cyathus and Nidularia.

Though most of these are too small to impose on one, the resemblance is singularly exact, and a large specimen might almost pass for the nest of some small bird, the eggs being admirably represented by the little oval fruits of the fungus. Even in such cases we must not too rashly conclude that the resemblance confers no advantage. The existence of attractive characters in so many fungi points to the conclusion that the same principles are in operation among them as among flowering plants. Numerous facts indicate a tendency in fungi to assume a guise which helps either to protect the plant or to promote the fertilization, germination or dispersion of its spores. If, as some mycologists believe, spores benefit through being swallowed by animals, it is easy to understand how a fungus might profit by being mistaken for a bird's nest containing eggs.

POPPIES AND POPPY LORE.

BY LORA S. LA MANCE.

"They bloomed in a lovely garden,
A group of poppies gay;
In robes of scarlet and purple,
Oh what so splendid as they?

So they shook their silken dresses,
And spread their skirts out wide,
And danced in the golden sunshine,
In a flutter of happy pride."

Like the rose and the pansy, the poppy has a personality of its own. It has all the languor, the passion, and the love of luxury of a child of the tropics. It seems to spring up from very gladness, laughs in the face of the amorous sun, gaily nods to the passing zephyr, and flutters its silken skirts as though to say, "Pray, who is as gay as I?" A brief and happy life, then off drop the shining petals, looking like butterflies as they float away with the coquettish breeze that woos them only to drop them later, crushed and broken, in some forgotten spot.

Little does the parent plant care for all this. To-morrow and the next day, new poppies will bloom, just as they did yesterday and to-day. No devotee of fashion was ever gayer, or more thoughtless of the morrow. Yet we love this careless prodigal for its very faults—for its jaunty sauciness, its coquettish grace, and its warmth. Long may it wave, dance in the breeze, and flaunt its glories at each passer-by!

The poppy blooms in every garden; its artificial counterpart nods from the hat of the summer girl; poetry teems with allusion to its flowers, "silken red," or to its "juices' soothing balm;" poppies amid a tangle of weeds and grain, peep from the artist's canvas, or grace the pictured page. It is an old familiar friend, and as a friend we trace its pedigree for a little.

The poppy comes down to us as a cultivated flower, from the haze of antiquity. The Greeks held the poppy sacred to Ceres, and the goddess was usually represented holding a poppy bloom in her hand. Mythology relates that when her daughter Proserpina was stolen from her by Pluto, that the mother wept day and night, until Jupiter took pity upon her and sent her poppies to eat, when sleep came to her eyelids and rest to her stricken heart.

This indicates that the poppy was at first appreciated more for its opium than for its flower. This is further carried out by the fact that the oldest cultivated species is the common opium poppy, Papaver somniferum, that has been cultivated so long before history begins, that its very birthplace has been forgotten, although it is supposed that it originally came from Persia.

As this is yet a work-a-day world, the poppy is still grown more in field than in garden, more for poppy-seed oil and opium than for its brilliant blooms. It is grown by the thousands of acres in Persia, Turkey, Egypt, and India. In Bengal, a white-flowered species, P. officinale, is grown in great tracts. Dr. Hooker describes such a poppy-field as "a green lake studded with white water-lilies." To a limited extent they are raised as a field crop in various other localities, but they can be grown with profit only where labor is cheap. Poppy-oil is made out of the seeds, and is bland and sweet. Artists use it in painting, and in southern Europe it is much used in cooking, just as olive oil is used. Opium, it goes without saying, is an even more valuable product. This is produced from the thick, gummy juices of the seed capsules.

This seed capsule that plays such an important part in the commerce of the world—and we might say in the vices of the world—is worth considering a moment. The poppy seed-pod is every whit as characterstic in its way of its parent plant as is the poppy blossom. Perhaps in all the realm of nature there exists no seed pod or capsule more odd. The science of botany tells us, with dry precision, that it possesses "a globose or rounded ovate capsule opening by a circle of pores under a persistent stigma," but the child who has enjoyed the privilege of a country "up-bringing" will tell you more graphiccally that "it looks like great-grandmother's sugar bowl, wtth little holes at the top, right under a crinkly little lid." Ah! how often ourselves, when a child, have we sprinkled our mud victuals from this same sugar-sifter of nature! And if the make-believe sugar was of a far darker hue than the sugar of the grocer, it but the better matched the earthy-blackness of the mud cakes in which our soul delighted.

But these capsules from which the opium of commerce is obtained, are no child's play. Nature herself declares that, by stopping up in P. officinale the most widely grown opium poppy, the cunning little openings through which the children's make-believe sugar sifts. Nor is this the only change. In our own land the tallest of poppies rarely reach a height of three feet, and the seed-pods on the largest specimens are not above an inch in diameter through the thickest part of the capsule. But the poppies of the Orient, grown for untold centuries for their capsule juices alone, are veritable giants, growing six feet high, and with seed pods that vary from the size of a hen's egg to a man's doubled fist.

A month after the flowers begin to open, the seed capsules assume this condition of aldermanic rotundity. All is bustle then in the poppy-field Early each morning, before the heat of the day, tireless Hindoos pass from plant to plant, deftly scarifying each swollen seed pod with the nushtur, a jagged saw-like instrument of iron. In a day's time enough juice has exuded through the wounded tissue to be scraped by other Hindoos with their sittoohas or scoops into the earthen kurrace, suspended by a belt to each operator's side. It is a slow, patient, almost endless task, and even when collected has to be subjected to other tedious and minute processes before the crude opium is ready to be taken to the godowns or opium factories. The total product of an acre of poppies is considerable, however, and hundreds of square miles are in poppy farms in oriental lands.

It seems a paradox that the easy, careless poppy should produce the most important drug in the pharmacopœia, but so it is. There is no other such a drug,—on the one hand, a boon to thousands of sufferers, giving rest and sleep, and freedom from pain; on the other hand, a bane to countless other thousands, dragging its victims down to the lowest depths of degradation, stealing from man his human soul, and leaving a mocking demon instead. Who shall say whether there is bound up in the congealed sap of the poppy-pod, the most good or evil?

But to return to the poppy as a flower. Starting originally from P. somniferum, one of the two so-called opium poppies, and Papaver rhoes, the corn poppy—a troublesome weed in Europe in spite of its picturesque beauty—with perhaps a fusion of other, but less known species, the modern annual poppies are derived. Some of them are tall and coarse, but more of them have handsome flowers of peculiarly high lustre and rich, diversified colors, bronzy maroons, blood-reds, scarlet-purples, silver-pinks and violet-lavenders, while the texture of the most-admired sorts is as soft and thin as the finest silk tissue paper. All of this class are as easy of cultivation as any weed. Indeed, one of the latest fads, and this time a really sensible one, is to treat the poppy as a wild flower, sowing it thickly along woodland walks or drives, or over grassy slopes that escape frequent mowing. Here they soon take possession of the ground, and give a bit of grace and bright coloring that adds much to the picturesqueness of the landscape.

The Iceland poppy is a biennial species, and although introduced in 1759, is yet rarely met with. The Iceland poppy is an illustration of the unreliability of common plant names. It is not found in Iceland at all, but in Greenland and Siberia. Lieut. Peary tells us that in the brief summer of Northern Greenland, the landscape is golden with a carpet of this beautiful poppy, Papaver nudicaule, each flower the size of a silver dollar. So sturdy is their Arctic blood, that under cultivation they frequently bloom in November and December.

The most gorgeous of all poppies are the perennial ones, generally called Papavers or Oriental poppies, from their having been brought originally from the oriental shores of the East Mediteranean.

If, as is said, the vileness of the poppy's breath will keep it out of Heaven, it is still good enough for earth, and long may it fill our gardens with its particular brightness!

Archaeology

Edited by Warren K. Moorehead, M. A.

SLATE ORNAMENTS AND CEREMONIALS.

BY WARREN K. MOOREHEAD.

Concluded.

Tubes were used among the Plain Indians (according to Catlin and Schoolcraft) by the medicine men for sucking evil spirits and disease from the bodies of the sick. Catlin goes into considerable detail regarding such practices of the Mandan doctors. Suppose a person ran a thorn into his foot and the sore had festered and become so inflamed that the subject was confined to his tepee. The doctor, having previously provided himself with a grub worm, a cricket, or some other insect, would visit the patient and carry out, in the presence of the family, numerous incantations and ceremonies. As a last resort he applied the stone tube (which he drew from his medicine pouch at the proper moment) to the wound, and after much gesticulation, he would spit out the grub or cricket which he had previously concealed in his mouth. Of course, the family supposed that the worm was the evil spirit causing the disease.

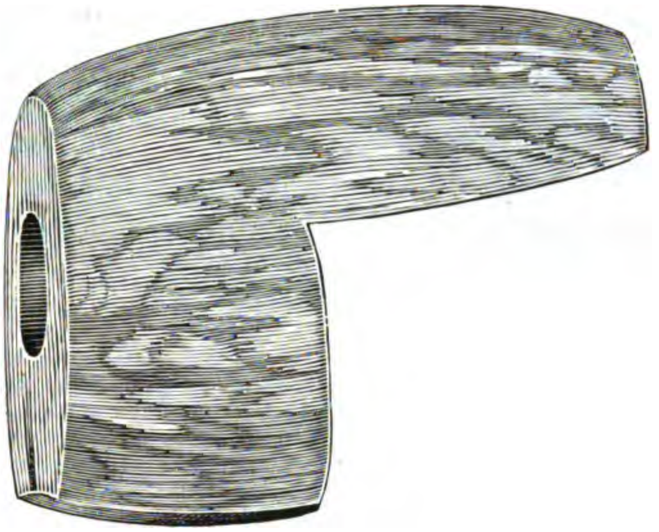


FIG. 6.—HAMILTON COLLECTION, WISCONSIN. MATERIAL, SLATE.

Since the tubes found generally throughout the Mississippi Valley are of the same form as those used among the Plain Tribes of historic times, it is not improbable that they were put to similar purposes. Many of them no doubt served as pipes, a stem being made of a small reed, hollow stick, or bone from the wing or leg of a bird. Others show at their end the marks of a cord by which they had been suspended, presumably from the neck of the owner. They have been called whistles, but such use is improbable, for any boy can emit a much louder and shriller whistle through his fingers than can be coaxed from one of these tubes. They have also been called telescopes, a rather large name for a small object, although on a bright day they would be of some service in looking at anything at a distance, by shutting off much of the light, and thus allowing the pupil of the eye to enlarge and take in more fully the details of the object under inspection. However, few observers class them as such.

Pendants.—This term may be applied to almost any of the articles under discussion, but I propose to limit it here to the small, flat, rectangular specimens usually made of slate, and having a single perforation near one end. When found with skeletons they are almost invariably upon the breast, and the marks of wear about the perforation show that they were hung around the neck.

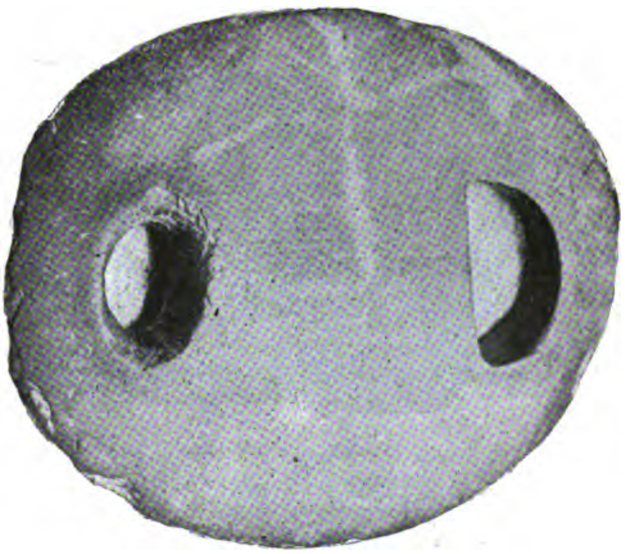


FIG. 7.—UNFINISHED CEREMONIAL, HANCOCK COUNTY, OHIO. MATERIAL, BANDED-SLATE.

Tablets or Gorgets.—These are flat, generally four-sided, but not often rectangular, being sometimes wider at or near one end, or having the sides curved either inwardly or the reverse. Often they are rudely decorated with incised lines, and various persons have almost worried themselves into insanity by trying to read the meanings of these scratches, which they persist in calling hieroglyphics. Possibly they had some meaning that we cannot now know, as in the case of so much of the picture writing of the Indians; but any effort to make out a system of written language from such markings, is only a waste of time. Scores of fraudulent pieces are in existence, which the deluded owners cherish as their most treasured possessions, and any attempt to undeceive them is often resented as being almost in the nature of a personal insult. So long as they are happy it is perhaps as well to let them rest; but in justice to their reputation for common sense, it is to be hoped that none of our readers will allow themselves to believe in the authenticity of anything of the sort that is different from the well-known system of sign writing that is in vogue among nearly all primitive peoples.

The specimens of this sort that I have found in mounds have nearly all been in such position as to lead me to the belief that they were worn on the breast.

Ceremonials.—The most singular of all ornamental or ceremonial objects is the butterfly or banner stone. The word banner means very little; butterfly is much more appropriate to their form. There are but very few whole butterfly ceremonials throughout the United States. Nearly all of them are broken. Not one of the best-informed archæologists can tell you positively regarding their use. I once heard an eminent archæologist give the following explanation; and while it is largely theoretical, yet it is the most plausible of any I have heard advanced. He said that in prehistoric times he believed that each clan or tribe had a special totem or coat-of-arms, as it were. He said that as catlinite was a stone used among tribes in historic times in pipe making; and that as it did not date back more than one hundred years before the discovery of America, some object or some material must have occupied its place; that at the time of La Salle's discovery of the Mississippi a large catlinite pipe was used by De Tonty as a symbol of peace, and that whenever he exhibited it in descending the Mississippi, the symbol was both understood and respected. The authority said that this butterfly ceremonial was possibly used in prehistoric times as an emblem of peace, or as a mark of distinction observed by all the tribes of the Mississippi Valley. It could not be maintained, he said, that these ceremonials were used exclusively by a single tribe. Those of West Virginia, of Ohio, of Kentucky, of Illinois and of Michigan are more or less alike, and the other village materials of these localities are vastly different. The type is very widespread, and therefore he would attach special significance to it. This was his opinion; and the readers of Popular Science News may accept or reject it.

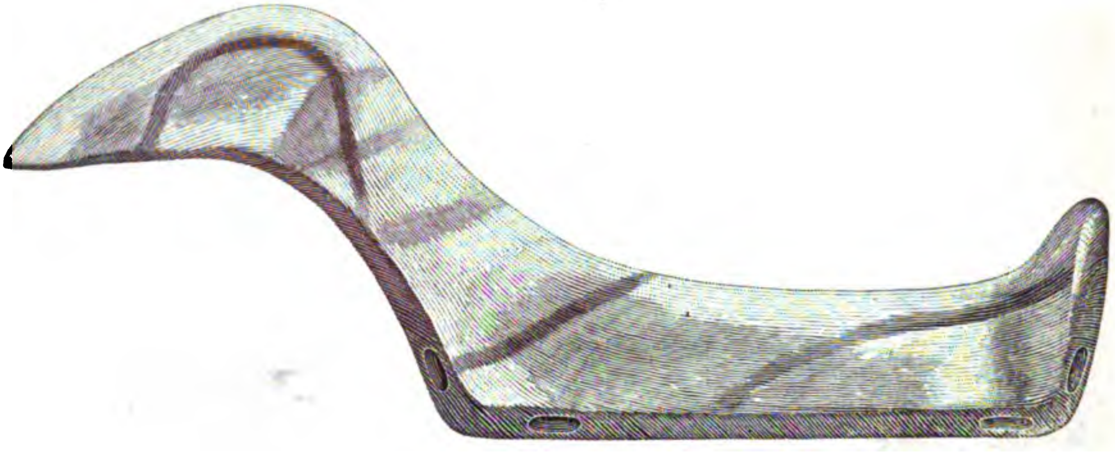


FIG. 8.—"BIRD-STONE." GRUHLKE COLLECTION, INDIANA. MATERIAL, BANDED-SLATE.

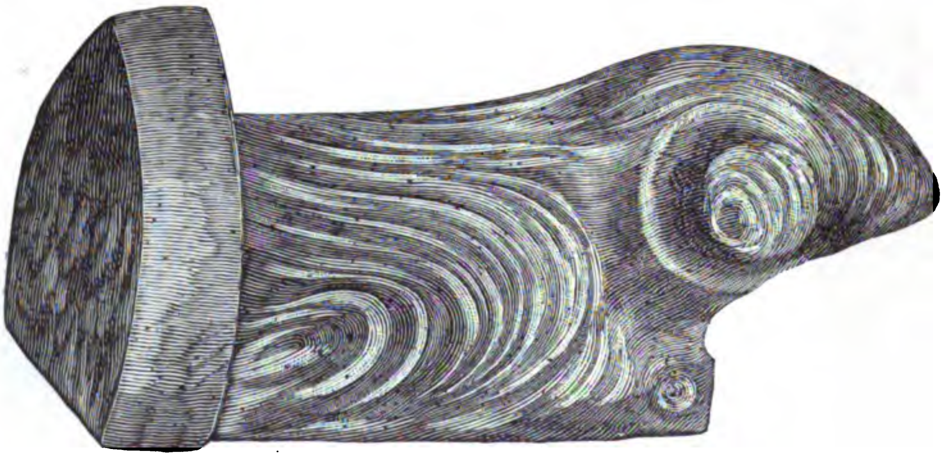


FIG. 9.—"BIRD STONE ?" MICHIGAN. MATERIAL, BANDED SLATE.

Odd Forms.—There are pick-shaped ceremonials, short stone tubes called beads, coffin-shaped stones, plummets, and a host of other varieties whose functions cannot even be guessed. There are broad objects of slate, drilled through the center and sharpened at each edge; these have often been called double-bitted axes, although not one of them could serve as an axe. The first strong blow would shiver it into fragments. Collectors having these objects in their cabinets would do well to label them with an interrogation point, for there is absolutely nothing positively known regarding them, and speculations are vain.

Bird Stones or Totems.—The bird or saddle stones are thought to have been worn as ornaments on the top of the head; the long bar amulets to have been worn upon the forearm.

The turtle-shaped stones, idols, effigies and like things mark the totems of tribes, their gods, etc. They belong more properly in another class, and will not be described here.

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New Archæological Society.

A new archæological society has been founded in Berlin for the purpose of conducting researches and excavations in Anatolia. Dr. Waldemar Beck, the explorer of Armenia and ancient Cappodocia, has been elected president of the society.

Extinct Bison.

Now and then palaeontologists are able to obtain complete skulls, with the horn cores attached, of the extinct "long-horned" bison, or buffalo, that roamed over the whole of North America before, during, and at the close of the glacial era, but the U. S. National Museum is the only institution that has been fortunate enough to secure a pair of horns of this animal. In fact, until the museum secured this pair of horns palaeontologists regarded such things as belonging to the realm of the vanished.

Cold and ice, however, will preserve anything, and during his last trip to Alaska Prof. Dall obtained these two horns from a glacial moraine, where they had lain in ice, snow, and freezing cold water, perfectly preserved, from the day the animal died centuries ago, in the late quaternary period, down to the present. These the professor has given to the museum, where they are shortly to be placed on exhibition. The old "long-horned" buffalo was a larger animal than the modern plains buffalo, and differed from the latter in the possession of horns as long as those of an old-time Texas steer.

FLINT IMPLEMENTS IN OKLAHOMA.

BY CHARLES NEWTON GOULD.

An article entitled "Ancient Quarries in Kansas" was published by the writer in Popular Science News in October, 1900. The quarries there described are located some 20 to 25 miles southeast of Arkansas City, Kansas, either near Maple City or in the Kaw reservation south of Norman. The last locality mentioned is known as the Timbered Mounds, and is situated on a hill just east of Little Beaver Creek opposite the mouth of Myer's Creek.

FIG. 10.—BOAT-SHAPED OBJECT AND CEREMONIALS. WEIR COLLECTION, IOWA. MATERIALS, SLATE AND PINK QUARTZ.

The geological horizon is not far from the base of the Permian, and near the top of the Flint Hills. Indeed the ledge in which the quarries are located is the highest, in other words the most western edge in the region that contains flint in any considerable quantities. The ledges to the east, however, ordinarily contain plenty of flint. It usually occurs as concentric concretions of all sizes up to those as large as a peck measure, imbedded in the hard, massive limestone that makes up the main part of the Flint Hills. These concretions either lie in rows or are scattered irregularly throughout the limestone mass.

On the hills at Maple City and at the Timbered Mounds this limestone containing the flint concretions has been quarried in large quantities. On the Timbered Mounds in particular there are immense amounts of loose fragments of limestone lying on the hilltops. The excavations from which the stone was taken may still be seen. Hundreds of car loads of the loose stone might be obtained from these localities.

The large amount of this material has attracted attention ever since white men have inhabited the country. Many theories have been advanced to account for the phenomena. The stone piles have been called mines, fortifications, houses, burial places and places of worship. The true explanation, however, seems to have been avoided.

A little search among the broken flint and limestone in these localities can scarcely fail to reveal the fact that much of this flint has been wrought by man. Imperfect implements, some nearly completed and others but slightly worked, may be found in considerable quantities. The quarries were doubtless excavated by the Indians in order to obtain flint from which to manufacture their weapons. Several hundred of these "rejects" or imperfect implements have been found. Some typical forms from this locality were on exhibition at the Pan-American Exposition at Buffalo.

The flint from this locality has certain peculiarities of marking that to the close observer tend to distinguish it from flint obtained elsewhere. The various shades of color, yellow, gray, brown, and the peculiarities of the concentric marking all combine to distinguish this flint from all other flint found in the West. Besides, a small fossil, Fusulina cylindrica, so abundant in the Flint Hills limestone, is also found in the flint from this locality.

So far as I have been able to learn, there is no other flint found between these hills and the Rocky Mountains. The only other quarries reported from the Plains that have come under my notice, are, one from central Texas and one from the extreme northeastern part of the Indian Territory, near the Missouri line. It has seemed reasonable to suppose that the tribes of the Plains came eastward till they reached the first limestone ledge that contained flint that could be quarried, and there stopped to fashion their implements. Nor was all the work done in the quarry. Many implements broke in the first shaping. These form the "rejects" found near the quarry pits. The partly finished implements were carried away to be finally dressed down at leisure.

This theory has at various times received substantial confirmation. On several occasions implements identified as coming from these quarries have been found at different points on the Plains. Near Arkansas City, Kansas, 15 miles distant from the quarries there are a number of so-called Indian mounds. Excavations in these mounds some years ago brought to light a considerable amount of pottery, bones and implements. Among the latter were certain flint flakes which were identified as belonging to the Maple City quarries.

Within the past few months another find has been made and at a much greater distance from the region. Mr. Geo. W. Darrow, of Mustang, Oklahoma, found in a field near his home some broken pottery and a number of pieces of flint. Among the latter was a broken implement, probably an ax, that evidently came from the Maple City or Timbered Mounds quarries. A flake of flint as large as a silver dollar found in the same locality contained the characteristic Fusulina. On the other hand, a number of flakes of flint found with those just mentioned evidently came from some other locality.

The field in which this material was found is in the southwest quarter of section 17, T. 10 N., R. 5 W. It is five miles southwest of Mustang, and 23 miles southeast of El Reno, Oklahoma, near the South Canadian river. The locality is more than 125 miles from Maple City. The specimens were kindly presented by Mr. Darrow to the museum of the University of Oklahoma.

University of Oklahoma.

Discoveries in Egypt.

Interesting discoveries were recently made by the Egyptian Expedition of the University of California, working near Girga under the direction of Dr. Reisner. Some of these discoveries have led those in charge of the expedition to believe that the prehistoric Egyptians were of the same race as the Egyptians under the Dynastic kings. It has been asserted heretofore by Egyptologists that there were two distinct races.

Dr. Reisner's workmen, while excavating recently in a cemetery, came across some bodies which had been preserved in a remarkable way. The people who used the cemetery had fortunately chosen a salty bit of ground for their burying place and the soil had mummified the bodies so that even the most delicate organs had been preserved in many cases. Dr. Reisner hopes to be able to send one of the bodies here.

The greater part of the bodies, however, are so fragile that they cannot be transported and they have to be examined on the spot if at all. In this work much valuable assistance was rendered by Dr. Grafton Elliot-Smith, to whom the Khedive granted two months' leave of absence from his work as professor in the Khedivial School of Medicine.

In one cemetery near Girga, Dr. Reisner's workmen found three groups of ten figures in all of household servants. Some of the figures were arranged as if they were carrying water, others were making bread, laying bricks, brushing flies from food. It is said that this is the first time in fifteen or twenty years that such figures have been found in position by European diggers.

In a funeral chamber, around the coffin of a man of the Fifth Dynasty, were found nineteen wooden statuettes which are described as characterized by rather unusually harmonious proportions and coloring. It is said that they represented the dead man, his wife and his children.

Among the most picturesque of the discoveries were two ships of the dead of the Sixth Dynasty, fully manned, each with a captain and six rowers, a helmsman, a coffin, a reading priest and a waiting woman. Other finds were a very full collection of early Eighteenth Dynasty pottery, containing some 400 pieces, twenty-five small pots of alabaster and blue marble, a child's rattle made of baked clay and a number of beads, knives and pots.

At Girga the excavators also unearthed over twenty houses of the Eighteenth Dynasty. A number of the houses had gayly painted walls and specimens of these will be brought here. A number of the skeletons found will be presented to the Egyptian Government for exhibition at the medical congress to be held at Cairo this coming winter.—Sun.

Anthropological Museums in Siberia.

For many years the government of Russia has been deporting to Siberia its men of the most active intellect, and turning them loose in a new country to make a livelihood for themselves and for their families. It is not strange, then, to note that universities and museums are springing up in Russia's eastern possessions, nor that many of the men of science and teachers on the staff are exiles.

Prof G. F. Wright, of Oberlin, described at the Pittsburg meeting of the American Association for the Advancement of Science some of the museums of archæology he visited in the Russian East. There is scarcely a town of 10,000 inhabitants in all Siberia, he says, but has a public museum, under the care of a learned and competent curator. In the older cities the museums often rival anything we have in the United States, except those of Washington, New York, Boston and Chicago. One of the finest of the Siberian collections is at Khabarovsk—a town whose very name is unfamiliar. The museum of Irkutsk is nearly a century old. Perhaps the most interesting and important establishment of the sort is at Minusinsk. Students from all parts of the world visit its collections. All these museums are supported and have been mainly built up by private contributors, and are the objects of local pride. Taken together, they represent an educational factor which is developed much more fully in Asiatic Russia than it is in America, and may well provoke our emulation.

The Hermes of Cythera.

M. André, the French artist, says the Athens correspondent of The Times, receives 20,000 francs for restoring the Hermes of Cythera. Had the year 1901 not been already famous in the annals of archæology for the discoveries in Crete, it would always be remembered owing to the finding of the bronzes at Cerigo (Cythera.)

The great bronze Hermes that was found in the sea off Cerigo was not perfect, and as it was also in fragments it needed most careful restoration. Dr. Charles Waldstein pronounces the figure to be a work by Praxiteles or of his school, and he and other experts declare that it is undoubtedly the finest Greek bronze yet discovered.

Aluminum.

The metal aluminum is chiefly produced from cryolite, a mineral found in Iceland.

Various Topics

OLD ROCK ERUPTIONS.

BY E. T. BREWSTER.

Every one, I am sure, who has walked about much in certain regions where metamorphosed bed rock comes up through the soil, has noticed certain narrow dark bands across the ledges. Any one who has thought it worth while to follow the course of one of these bands, has probably found that it remains about the same width, however far he traces it, until it finally disappears from view under the loose earth at the side of the rock.

Sometimes, however, one notices that the band is branched. Sometimes he sees that the width varies irregularly from place to place. Sometimes he finds that the seam gets narrower and narrower until it comes to an end, where it is no thicker than a sheet of cardboard.

Now these "dikes," as they have been named, are really old fluid or semi-fluid substances long since hardened into solid rock; in some cases they are the lavas of old volcanoes which were active ages and ages ago. Good pictures of volcanoes are so common that we all know how they appear at the surface of the earth. But a volcano may extend miles under ground. Who ever thinks what it is like there? We all know of the cone of the volcano, and the crater in the top with the mass of melted lava at the bottom in what is often called the neck. Below this, may be an irregular fissure which connects at the bottom with some lake of melted rock, many times farther beneath the surface of the earth than the top of the mountain is above it.

While the volcano is active, earthquakes, eruptions and explosions crack and shatter the rocks for some distance around. If any one of these cracks reaches the liquid rock below, the melted lava at once runs into it like water into a crack in the ice. Bye and bye, when the volcano becomes extinct, as all volcanoes do in time, everything freezes to solid rock and the lava filled cracks remain as the dark bands which we see.

But if dikes are formed so far underground, how is it that we now see them on the surface? In the first place, many cracks did actually come to the surface of the earth and let the lava flow out in vast sheets, such as still remain in Oregon and Washington. Then, in the second place, the rocks are always decaying into soil, and the soil is always being washed away by the rain and carried off by the rivers into the sea, until, after many ages, things come to light which were once miles under the ground.

Volcanoes share the fate of other things. In Arizona and New Mexico are several old volcanoes, now nearly worn away, and still others where the cone is entirely gone but the hard lava of the necks remain standing above the landscape, like the stumps of gigantic trees.

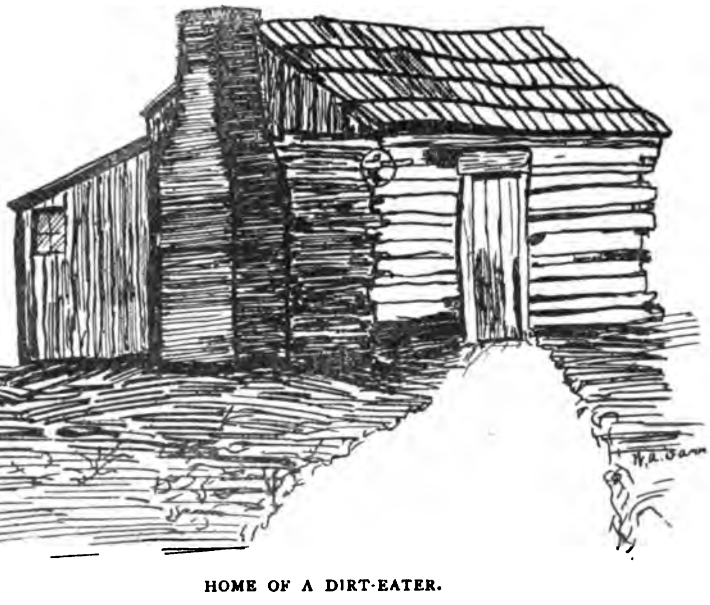
Examine a dike; look at the edge of the land, and see how the hot eruption has baked the rock next it for more or less than an inch. See, too, how the intrusive material has a slightly different grain where it hardened quickly against the cooler sides of the crack.

In what has been said, it is not intended that all trap dikes were connected with a volcano proper,—that is, a cone or mountain formed of molten lava. The systems of dikes all along our Atlantic slope, and familiar to many in the Connecticut valley, form too extensive a linear feature, to be referred to any circumscribed volcanic eruption. Many of these dikes show that the intrusive material came up laterally through strata of rock. In the sinking of mesozoic deposits into troughs of subsidence, the lower part of the trough descended into a zone of softening heat, and, in the ruptures of the syclinal, the fluid material was forced up into any opening, whether a vertical crack or sidewise between parting strata. And it might have come up as a steaming, pasty mass, not always as molten lava.

DIRT-EATING.

BY WM. A. DAVIS.

To my mind, among the many diseases that afflict humanity, dirt-eating or chthonophagia as it is termed in medical works, is the strangest. The disease is characterised by an irresistable desire to eat dirt, and is common in the southern part of the United States where I have been engaged in teaching during the past four years.



HOME OF A DIRT-EATER.

Before the war, when the horn of plenty was full to overflowing, cases of dirt-eating were rare and found only in the poorest families of whites and negroes. Now it is an easy matter to find them; for the disease is a child of poverty who is queen over a wide extent of old worn out plantations, and rules the dwellers thereon with rentless hand. I had read descriptions of the disease in medical works, but gave it only a passing thought, and it was merely by accident that it was brought to my mind again.

A 35-YEAR OLD DIRT-EATER.

One of my students, a young man of ordinary intelligence, was very irregular in his attendance at school, and gave as an excuse, poor health; and judging from his looks, I could not doubt it, for he had every appearance of one on the very verge of the grave. His face was pinched and drawn, his body greatly emaciated, and his complexion the color of yellow clay; the latter peculiarity attracted my attention, and, calling upon the superintendent of the boarding hall,—a man who had been born and reared in South Central Mississippi,—I told him that I was much worried over the condition of the young man's health, and asked him what he thought of sending him home to his parents. "Why," said the superintendent with a smile, "he's a dirt-eater, that's what ails him. He'll be all right when we get him fed up."

Finding me desirous of learning more of the "dirt-eaters" as he called them, he informed me that there were a great many scattered over the country; that the disease usually appears in early childhood. In some the desire to eat dirt comes on at long intervals and that class may live to attain a good old age; but those who indulge in it daily do not reach middle age.

The dirt that is eaten contains no grit and consists of dried clay from the old fashioned stick chimneys, quite common here, or clay dried by the sun; when neither of these is to be had, any kind is used. Those addicted to the habit are very secretive and cunning, and can only be detected by its terrible effects upon their health. Wholesome food, warm clothing and a comfortable home, are the soverign remedies, and sometimes, when the disease gets a firm hold, even these fail to effect a cure until the patient is confined and closely guarded for several months.

THE HARVEST MOON.

BY ARTHUR K. BARTLETT.

Near the time of the autumnal equinox in September, the moon, at her "full," rises shortly after sunset for several evenings in succession, which circumstance gives rise to a series of brilliant moonlight nights, and the moon being above the horizon until late in the morning, presents a charming appearance besides prolonging the light, which is so beneficial to the husbandman at this season of the year. The full moon that occurs nearest to September 22 has long been known as the "harvest moon" on account of the peculiar advantages derived from moonlight during the time of harvest. In England its yearly return is always celebrated as a festival among the peasantry.

The beautiful appearance of the harvest moon has from time immemorial attracted the attention of the poets, many of whom have made it the subject of their song, and Henry Kirke White, who died at the age of 21 years, wrote these beautiful lines:

"Moon of harvest, herald mild
Of plenty, rustic labor's child,
Hail, O hail! I greet thy beam,
As soft it trembles o'er the stream,
And gilds the straw-thatch'd hamlet wide,
Where innocence and peace reside;
'Tis thou that glad'st with joy the rustic throng,
Promptest the tripping dance, th' exhilarating song."

The circumstance of this moon rising for several nights in succession at nearly the same hour, immediately after sunset, has given it an importance in the estimation of farmers, but it is not the less remarkable for its singular and splendid beauty, as no other moon during the year can quite equal it in brilliancy and magnificence. At its rising it has a character so peculiarly its own, that the more a person is accustomed to expect and to observe it, the more it strikes him with astonishment. The warmth and dryness of the earth, the clearness and balmy serenity of the atmosphere at this season, the freshness which comes from the evening, combine to make the twilight walk delightful; and scarcely has the sun departed in the west, when the full moon in the east rises from beyond some solitary hill, over a broad lake, or from behind the dark rich foliage of the trees, and sails up into the still and transparent air in the full magnificence of a world. It appears not as in common, a fair but flat disk on the face of the sky, but we behold it suspended in the crystal air in all its greatness and rotundity; we perceive the distance beyond it as sensibly as that before it; and its apparent size is surprising to us as it rises above the horizon.

The annual appearance of the harvest moon was noticed and anxiously awaited by the husbandmen long before they could interpret the phenomenon, from the fact that it enabled them to lengthen the day's work during the haste of gathering the autumnal crops, as the moonlight evenings continued for an unusually long time. The moon travels towards the east and therefore comes to the meridian about 51 minutes later each succeeding night, and if the interval between her rising and her arriving to the south were always the same, she would rise 51 minutes later each evening, on the average. As the solar day lengthens fastest at spring when the sun crosses the equator from south to north, so the time the moon is above the horizon lengthens most, day by day, when the moon is crossing the equator from south to north, as she does in September every year.

We have at and near the time of full moon in September, the singular spectacle of the moon rising not far from six o'clock in the evening. A moon nearly full, afterwards quite full, and then for a day or two still nearly full, rising night after night at nearly the same hour, remaining also longer above the horizon each night, obviously serves us for the time being in the most convenient way possible. At this time, moreover, when the moon rises night after night at nearly the same time, the nights are lengthening fastest, while the time the moon is above the horizon is lengthening still more, and therefore, in every respect, the moon is then doing her best, so to speak, to illuminate the nocturnal heavens. The full moon that occurs in October, which exhibits in almost the same degree the curious phenomena described, is sometimes called the "hunter's moon," and it is about equally beautiful and attractive in its appearance.

The harvest moon is not generally understood by the public, but the true cause has long been known to astronomers and can be very easily explained. It arises from the fact that the ecliptic, or the sun's apparent path through the heavens, is variously inclined to the horizon at different seasons of the year. The celestial equator is always at the same angle with the horizon, and hence equal portions come above the horizon in equal periods of time. If the moon moved in the celestial equator she would rise and set directly in the east and west points of the horizon respectively, and she would rise later each night by a nearly constant interval. But the moon moves in a path which is constantly inclined to the ecliptic at an angle of about five degrees, though for the present explanation she may be regarded as moving in the ecliptic; and as the ecliptic is inclined to the celestial equator at an angle of 23½ degrees, the moon, in all parts of her orbit, does not rise at equal intervals on each succeeding night. When the constellation Pisces is in the eastern horizon the ecliptic stands at the least angle. Now, in September, at the autumnal equinox, the sun being in the constellation Virgo, the moon at her "full," when opposite to the sun is in Pisces, and rises at sunset. On the following night, though the moon has advanced in her orbit about 13 degrees, yet her path being very oblique to the horizon, she will be but little below her position at the same time on the preceding night. She rises, therefore, only a little later, and for several evenings appears in the east at nearly the same hour after sunset, claiming our admiration as the "harvest moon."

Though the differences in the time of the moon's rising are always great when she is in or near the constellation Virgo, and small when she is in or near Pisces—that is, every month—we never notice these variations except in autumn. In fact, we seldom observe the moon's rising at all unless it be when she rises near sunset, or in the early evening. We usually give more attention to the full moon, and the moon can be full in or near Pisces, where the difference in the time of her rising is least, only when the sun is in or near Virgo, which can not occur except in September at the time of the autumnal equinox. In March the conditions are reversed, and the moon, at her "full," rises on successive evenings later than at any other time of the year.

In our latitude, the difference between the hours at which the full moon rises on successive evenings in September, amounts, on the average, to rather more than 20 minutes, or about half an hour less than the mean interval, while in March the average difference is about one hour and 20 minutes, the least possible variation in the time of her rising being 10 minutes, and the greatest one hour and 30 minutes. Those parts of the ecliptic which stand with the smallest angle set with the greatest, and those which rise with the greatest set with the least, so that while in September the full moon rises at nearly the same hour on successive evenings, the time of setting varies considerably, owing to the larger angle of the ecliptic with the western horizon.

The phenomenon of the "harvest moon" is much more striking in northern Europe and in Canada than in the United States; and in very high latitudes the moon, when it has its greatest possible declination, becomes circumpolar for a certain time each month, and remains visible without setting at all (like the "midnight sun") for a greater or less number of days, according to the latitude of the observer.

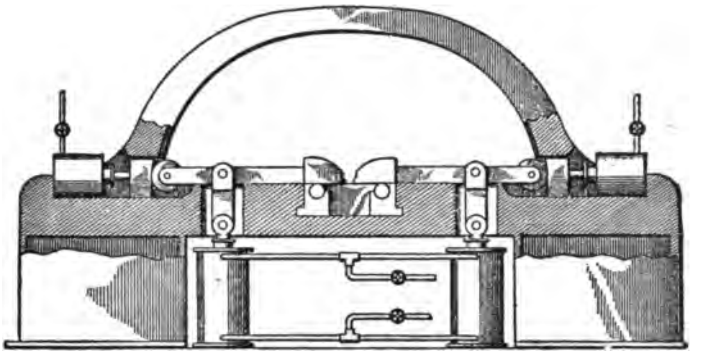
The late Prof. Proctor, in a very instructive essay on the subject, says: "The reader must not fall into the mistake of supposing, as I have seen sometimes stated in text-books of astronomy, that we are more favored in this respect than the inhabitants of the southern hemisphere. It is quite true that the same full moon shines on us as on our friends in New Zealand, Australia, and Cape Colony, and also that our autumn is their spring, and their spring our autumn. But the full moon we have in autumn behaves in the southern hemisphere not as with us, but as our spring full moon behaves; and the full moon of our spring, which is their autumn, behaves with them as our autumn moon behaves with us. It is, therefore, for them a harvest moon if it occur before the equinox, and a hunter's moon if it occur after the equinox. A very little consideration will show why this is. In fact if, in the explanation given above, the words north and south be interchanged, and March 21–22 written for September 22–23, the explanation will be precisely that which I should have given respecting the harvest (or March) moon of the southern hemisphere, if I had been writing for southern readers."

The moon's nodes are those points in her orbit at which she crosses the earth's orbit or ecliptic. The place where she passes the ecliptic in moving north is called her ascending node, while the opposite point or the place where she intersects the ecliptic in moving south, is termed her descending node. These nodes do not remain stationary, but move backward on the ecliptic from east to west, completing an entire revolution in about 18 and six-tenth years. When the moon's ascending node is in or near the constellation Pisces or the vernal equinox, the interval between successive risings will be yet more shortened, and the harvest moons are then most beneficial to us, but if her descending node is situated in or near Pisces, the effects are diminished and the phenomena are least beneficial to us.

The husbandmen of old believed that the so-called "harvest moon" was a divine interposition to prolong the day and thus aid them, but science has shown that the phenomenon is simply the result of natural law.

POLISHED BLADES FORGED ELECTRICALLY.

“The way to make excellent cutlery is, without a blacksmith, without a grinder, and without a polisher.” Such is the startling declaration of an inventor who is preparing to manufacture blades for razors and other fine cutlery by a process which is indeed revolutionary. Under the only methods of manufacturing cutlery now in use anywhere in the world, the blacksmith, the grinder and the polisher are each most important factors. It is difficult enough to imagine how any one of these is to be eliminated from the process but that they are all three to go, truly makes one marvel.



ELECTRIC FORGING FURNACE.

Apparently the only skilled workman left, under this process, is the temperer. Electricity is to be the wonder-worker, aided by vacuum pumps, refrigerating machines and clever power forgers. The new process is the invention of Joseph Misko, M. E., of Pittsburg, Pa.

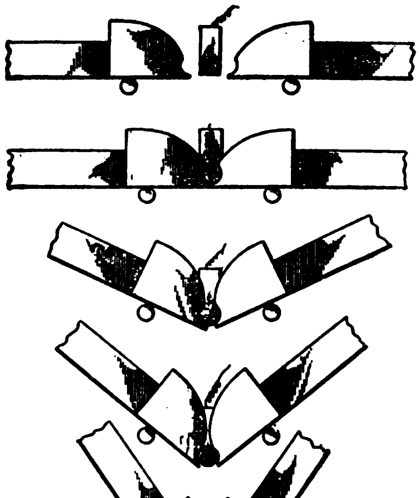
In the Misko system the usual process of manufacture is reversed. The grinding and polishing are done before the forging is begun. A rod of steel ten feet long or of any other convenient length, is taken for this initial process. The rod is ground on all sides and polished. In this state it contains just enough material for the forming of the blades into which it is to be converted. It is now ready for the forging.

The forging machine is a tunnel of steel a little longer than the steel rod. Lying along the middle of this tunnel and with their ends separated enough to receive the prepared rod and yet not touch it, is a double row of dies reaching almost to the full length of the rod.

Each pair of these dies is ready to form a blade, each die forming one side of it. The upper part of the tunnel is an arch of steel which trusses the dies together and serves also as a guide to them in their forging operation. At each end of the dies are hydraulic presses and there are more of these below the dies on either side.

The operator thrusts the rod of cold polished steel into the tunnel and between the die heads. He closes the door and touches a button. Powerful pumps quickly exhaust the air out of the machine. As the door closes and seals itself, electrical connections are made on either end of the polished steel rod. As the air disappears from the inside of the chamber the electric current is turned on. In a few seconds the rod is at a cherry-red forging heat. Another touch by the operator and the dies close together, forming with their ends the backs of the blades into which the rod is to be transformed. Another touch and the far ends of the dies begin to travel up the arched sides of the tunnel. As they move the inner ends close more and more with a revolving motion, squeezing down the steel between them until at the last it is forced into a very thin edge.

The operator returns the dies to their places, cuts off the current and opens the machine. The steel rod has been transformed into a series of shining polished blades. There are nicks between the blades, marking where they are to be broken apart later. As there was no air in the forging chamber the blades have lost none of the brightness of the polished rod of steel.



HOW A RAZOR BLADE IS FORMED.

The next operation is the hardening. Again the rod of blades is placed in a tunnel and the air is exhausted. This time instead of dies there are on either side of the rod heads of metal indented to fit the blades and inside each head runs a stream of refrigerating brine, cooled to below the zero of the thermometer. The current is again applied to heat the rod of blades and when they are glowing the refrigerated heads close together, chilling the thin steel, but doing it so evenly that it is claimed that there is no tendency to produce warping or cracking.

Still the blades are bright and polished when they come from the hardening machine. To put the finishing touch to the blades, Mr. Misko has devised a refrigerated grinding and polishing wheel on which the cutlery would be kept from losing its temper though it were ground dry as is the custom. These wheels are of hollow iron with the abrasive substances cemented to their outer edges and the whole kept cool by a stream of freezing brine run through the inside of the wheel. A factory to make use of this process will soon be erected at Newcastle, Pa.—Elect. Age.

THE EVIDENCES OF DEATH.

BY DR. R. W. SHUFELDT.

A consideration of the evidences of death is a matter of prime importance from whatever point of view we may be pleased to regard it There is no question on this head when we come to view the subject from a medico-legal point of view, or of its various aspects as they appear to the student of forensic medicine. But for the naturalist,, the sportsman, and the explorer, this inquiry is one of distinct interest and very decided import.

Let me give some instances. Two hunters may be out together and far removed from medical or other assistance in case of accident to either one of the party. Accidents, however, frequently happen under such circumstances, as drowning, gunshot, hæmorrhage, syncope, heart failure, apoplexy, sunstroke, and many others. Often these prove fatal, and there is nothing left for the injured one of the pair but to return to civilization and make the arrangements to convey the body back to the hands of friends or relatives.

Before the comrade decides to take this step, however, it is very important for him to know, and to know beyond all peradventure, whether his fellow in the trip is absolutely dead or not. The knowledge of this fact will not only influence him in the matter of remaining any longer with his fallen friend, and to make further attempts to restore him to life, but it will, in the case of death, put in his possession the actual information it will be his sad duty to impart to those concerned in the victim's welfare when he returns to them. Or, if the one who has met with the accident is not actually dead, it will influence the one with him, in the matter of very promptly securing the necessary aid to resuscitate him, if the circumstances admit of it. In short there is no end to the variety of the cases where the ability to pronounce the victim of an accident dead or the reverse is of the greatest importance, and, as I say, it is a question that comes directly home to those who are habitually in the field, and employed in a manner where many kinds of accidents may happen at any time.

Then the question of the burial of the body enters into the matter, and the various considerations it involves. And, here it is again where the ability to say that the person is completely deprived of life is of the greatest importance. Of course, in a vast number of cases, there will, and can be, no doubt in the premises, as where a man has his head blown off with a shotgun, or is frozen so stiff from head to foot that the body absolutely looks as though it were made of ice, and similar cases. But, on the other hand, a man may fall in a trance state; or from an attack of the heart; or be brought almost to the point of death in drowning; or suffer from a sunstroke or an apoplexy, and remain in apparently a lifeless condition for hours or even for several days, depending on the nature of the trouble, and then be restored suddenly to life again, with the chances of living many years afterward. I could recite not a few instances wherein I have been one of the actors in cases of this character, and usually have been the one called upon to give the opinion,—the final opinion,—as to whether the body of the victim of the accident, or other trouble, was lifeless, or that, in other words, the very last spark of life had departed. For in any case there is always some hope if there is any life left at all.

A single instance of this nature must suffice here to illustrate my subject. A good many years ago I was suddenly called one day, as a surgeon, in the case of a young woman who had, when apparently in robust health, and without any warning, fallen as though dead. When I arrived at the house they had picked up the body and lain it on a bed. Within the following two hours I examined the victim with unusual care, and then pronounced her dead from heart disease. But this by no means satisfied the young husband, who was nearly beside himself with grief at the loss of his pretty wife. The following morning the body was still warm, and rigor mortis, or that rigidity which usually occurs shortly after death, had not taken place. This convinced the poor husband more than ever that I was mistaken, and it was with no little difficulty, that I succeeded in getting him to tell me, that in the event his wife was dead, what disposition he intended to make of the body. It was to be forwarded east, and would require nearly a week to reach its destination. Then I suggested that an embalmer be summoned, and after the lapse of another day, the man arrived. Here was another dilemma, for he sided with the husband and declared the woman still lived. The scene was far out on the western plains, and there was no proper person to call in to confirm my diagnosis. I requested the husband to leave the room, and I found myself alone with the embalmer and the body. A few questions on my part soon convinced me that the former was not what might be called an expert in his calling, and I, in a very little while, had him at my command.

The body was still warm and pliant, and as she lay there on the bed, she appeared far more like a person in a restful sleep, than one from whom the last spark of life had fled several days before. I produced from my case a small laryngoscopic mirror and informed my companion that I intended, after opening the mouth, to hold it, face downwards over the upper extremity of the windpipe (larynx). If upon quickly withdrawing it, it was noticed that the moisture due to the breath had gathered on the glass,—the woman was still alive, but if not, this was at least one evidence that life had departed. When the mirror was withdrawn there was not the slightest sign of moisture upon it. I made no remark but let the fact work upon his mind. In a few moments more, I said abruptly, 'See here,' and taking a large surgical pin, 'if I thrust this pin in this woman's limb, and then withdraw it, you'll find that the puncture it makes does not close up,—but it will if she be still alive.' He had never heard of this before, and as I quickly resorted to the operation, it took him somewhat by surprise, especially as it tended, upon examination, to powerfully sustain my opinion.

Now I said 'this woman's body has not been moved for at least forty-eight hours; will you kindly roll her over into the prone position,—you will find her back very much discolored, in patches, it being due to the determination of the blood, to the lowest parts of the body.' He did as I directed, and found things as I had predicted, and then he gave way, and declared I was no doubt right, and that the women had fallen dead. 'Ah!' I said, 'then you do not care to have one apply the battery and prove to you that her muscles will not respond to its application.' "No," he answered, "I do not think it necessary." He then proceeded with his duty, but as I glanced at him askant, I observed that he was by no means entirely at ease when he came to make his preliminary incision over the femoral artery. Finally, with a shudder, he said: "Here, Doc, you expose and divide the vessel for me, and then I'll go ahead." It was done.

In some cases where the laryngoscopic mirror is not at hand, a piece of broken looking-glass will answer the purpose, or, if skillfully employed, the bright blade of a penknife or razor, but these latter are not so safe as indicators.

There is another class of cases, or several classes rather, that interest hunters and sportsmen. It is an interesting study to ascertain whether one can always be certain that an animal is dead; or, whether an animal is sure that a man is dead; or whether one animal can tell when another animal is dead, be it of the same or another species.

There is a great deal that I could write upon all of these cases, but space in the present issue prevents, but I shall take the matter up later on. Here is a case in point, however. A party of four men were hunting elk in the Laramie Hills. They had shot down a big bull, on a rugged mountain side. The slain monarch of the forest lay absolutely motionless, and every one of the party were convinced that the animal was quite dead, and they approached their game in the most offhand sort of a way. Two took the animal by its ponderous antlers; two took him by the hind legs; and by a combined effort they tried to pull the brute round where they wanted him;—when, all of a sudden, and without an instant's warning, this great bull elk, gave a vicious swing of his head, and two tremendous kicks with his hind-legs, and up he starts to his feet. He had nearly succeeded in disemboweling one of the party at his head, while he had kicked the other two a dozen paces or more down the side of the mountain, breaking the leg of one of them.

Here is a case where it would have been an advantage to the party to have been able to say positively, that that elk was dead.

There are no positive means known to me by which a man can tell, at a distance, say of fifteen feet, whether the deer he has shot down, and appears dead, is actually dead or not. The matter of time, or another bullet, of course, will settle it, but such expedients are either very impracticable or very undesirable. The safest way is to approach the fallen game at a safe point and not only this, but if there be any doubt at all in the mind of the sportsman, let him always approach his fallen game well prepared to shoot again at an instant's warning.

I nearly had my neck broken once by incautiously taking hold of the horns of an exceptionally fine buck antelope I had shot down near Laramie Peak. Keep away from the antlers and legs, until all doubt of the game's 'state of health' is removed. In some animals the eye-lids quiver when they are not dead, and in very cold weather, sometimes the frozen breath's vapor may be noticed at the nostrils or at the mouth. Look carefully at the belly, and see if there be any evidences at all of abdominal breathing going on. Even at very close range, sometimes a field glass will assist in telling the story. And, in all instances be cautious, cool, nervy, and not in too much of a hurry to count the number of points on the antlers, or measure and weigh your fallen game.

Mineralogy

[Edited by A. C. BATES].

Dislocated Crystals of Quartz.—These are crystals that have been broken at some period of their growth, caused by the motion of the inclosing rock, by earthquake or other natural phenomena, and the broken parts have been held closely enough to "heal" by the transfusion into the rents of fresh silica. Sometimes this healing process is so nicely done that the internal structure, viewed under a strong magnifying glass, shows no break or waver of continuity, although the external exhibit proves the break, as in Fig. 1. Other specimens will show breaks that have healed with the related parts of the crystals at angles varying greatly. But the majority of breaks occur just below the pyramid, which seems to slide to one side, more or less, and is there held by contact with the associate crystals of the group while the healing process goes on. See Fig. 2. All the observed dislocated crystals, large or small, were parts of groups of crystals. The slender crystals of Arkansas suffer most in this respect. Two parts of one large smoky crystal found in a pocket of feldspar at Pike's Peak, Colo., show a healing over of the fractured ends. There is in these maimed crystals good material for studying crystal building.

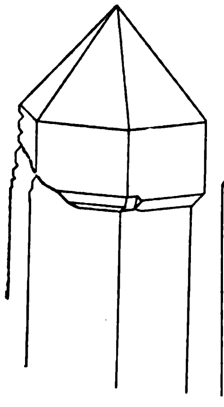


FIG 1.

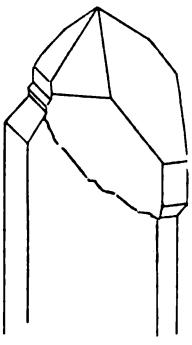
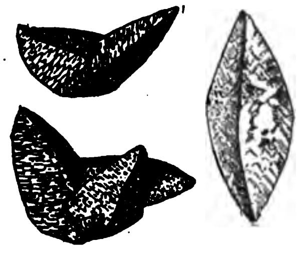


FIG. 2.

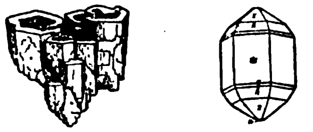
Large Meteorites.—Prof. H. A Ward describes a large meteorite that exists at Bacubirito on the Rio Sinaloa. When it was struck by the plough of a farmer in 1871, he uncovered enough of its bright surface to convince him that he had found a silver mine. Mr. Ward dug down to the solid porphyry rock on which the meteorite rested, and turned the mass off its base finding a clean depression crushed into the rock. The dimensions of the meteorite are: Length, 13 feet 1 inch; width, 6 feet 2 inches; thickness, 5 feet 4 inches. The five largest meteorites known are: that of Bemaego, Brazil (5⅓ tons); Chupaderas, Mexico (15⅔ tons); Bacubirito (about 50 tons); San Gregorio, Mexico (11⅛ tons); Anighito, Greenland (about 50 tons).

Strontium ores are in demand for use in refining beet sugar and in the defecation of sugar contained in molasses. Strontium salts are used in pyrotechnics for red fire. Celestite, a strontium sulphate, and strontianite, a strontium carbonate, are the sources of strontium salts, which product is imported principally from Germany, the crude mineral being derived from Westphalia, Thuringia and Sicily. Celestite and strontianite are found at several places in the United States. Celestite is found in large sharp crystals on Strontium Island, Put-in-Bay, Ohio, and in neat, bluish crystals up to three inches in length in Mineral Co., W. Va. Celestite is usually opaque white, bluish white or celestial blue.



CELESTITE.

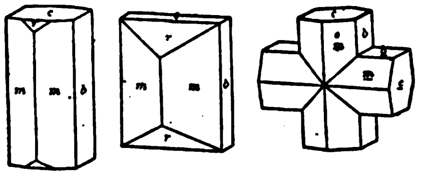
Vanadinite.—The finest specimens of this mineral were found several years ago in Yuma county, Arizona. The crystals were brilliant, deep red in color, prismatic, with smooth faces and sharp angles, sometimes cavernous and implanted generally on a rusty matrix. Some collectors hold the opinion that it is the handsomest mineral found in this country. The crystals are usually small, seldom exceeding a half inch in length. Quite a large deposit was recently found near Telluride, Col., and the mineral is being mined for use in the manufacture of steel. A small part of vanadium trebles the tensile strength of steel. As good specimens of vanadinite are rare and costly, collectors would welcome the news of a large find and offering of the crystals.



VANADINITE.

Pumice.—During the summer of 1897 several extensive deposits of pumice were discovered in Nebraska. Another deposit was discovered in South Dakota, about three miles east of Pine Ridge Agency. The volcanic ash of which these deposits were composed was probably brought by the winds from volcanoes in Colorado and New Mexico, and deposited in the lakes and other water courses which at that time covered this region. A deposit of lump pumice stone has been found in Millard County, Utah, and is the only known deposit of lump pumice stone in the United States. A large deposit of pumice is reported as occurring in Sonoma County, California. On account of the distance of these deposits from the railroad and from the large markets, they have not been able to compete with the pumice imported from Lipari, Sicily, which is shipped as ballast and sells in New York, after being ground and bolted, at from 2 to 2½ cents per pound.

Staurolite occurs imbedded in mica or other schists or gneiss, and is found abundantly in the schists of the New England states and in Virginia. The forms of the crystals are many,—simple, complex and cruciform twins. Staurolite is usually opaque and reddish-brown or black in color. It is a basic silicate of aluminum, iron and magnesium. Perfect and well-formed crystals of this mineral are often mounted to be used in jewelry, as necklace and watch chain pendants. The cruciform crystals have been widely advertised as a lucky stone to ward off danger and disease, and have found large and ready sale among ignorant people, especially southern negroes.



STAUROLITE.

Crystalline Quartz is used principally as a wood finisher, and the entire production of this material for this purpose is accredited to Connecticut. Crystalline quartz is used also as an abrasive in the stonecutting trade, and a small amount of quartz is crushed and sized for use in the manufacture of sandpaper. The production of crystalline quartz in 1901 was 14,050 short tons, valued at $41,500. These values are for the crude quartz; after it has been prepared for market its value is from three to four times as great.

Oilstones and Whetstones.—In the United States, rocks suitable for making whetstones are found in Arkansas, Indiana, Ohio, New York, Vermont and New Hampshire.

The Arkansas whetstone quarries are in Garland and Saline counties,—the principal ones being on Quarry or Whetstone Mountain, near Hot Springs, Garland County. The sandstones of Orange County, Indiana, furnish a whetstone known as the Hindostan or Orange stone. In Ohio, at Berea, Euclid and Chagrin Falls, in Cuyahoga County, and at Grafton and in Lorain County, whetstones and oilstones are produced. In Cortlandt County, near Labrador Lake, in New York, the Labrador stone is quarried for whetstones. In Haverhill Township, Grafton County, New Hampshire, and near Lamoile, Orleans County, Vermont, are the quarries for the celebrated Indian Pond, White Mountain and Lamoile scythe-stones. The production of oil-stones, whetstones, etc., in 1901 amounted to $158,300; the imports are valued at $64,655, and the exports were in excess of the imports.

The production of grindstones in the United States is almost entirely from Ohio and Michigan. The principal grindstone district in Ohio is included in Lorain, Cuyahoga and Summit counties, with Cleveland as a center, the largest grindstone quarries and manufacturing plants being within twenty-five miles of Cleveland. The quarries in southern Ohio are along the Ohio river, west of Marietta. A few quarries are in West Virginia, across the river from Marietta. The Michigan quarries are on the shores of Lake Huron, near Grindstone City.

New Use for Zinc.

A recent invention for the preservation of timbers by the use of chloride of zinc promises to create a greatly increased demand for this metal. The process is a very simple one, and consists of extracting the saps and other juices of wood, and replacing them with the zinc chloride which penetrates all the pores, and renders it impervious to the decaying influences of moisture for a period three times as long as wood in its natural condition resists decay. It is now used for the preparation of railroad ties.

The ties are loaded upon a car which is taken into a tubular retort so constructed that it can be hermetically sealed. A jet of steam is first introduced which is kept at a pressure of twenty pounds for three hours, the temperature being 250 degrees F. This softens and liquifies the pitchy and gummy material. The conditions are then reversed and a big air pump is applied, creating a vacuum for an hour during which time the pitch and sap loosened by the action of the steam are drawn out of the timber, and with the condensed steam collected in the retort below the ties.

Upon the release of the vacuum, a drainage pipe at the lowest point of the retort draws off the extracted material, and the inclosed timbers are thoroughly washed to remove all remaining pitch or gum. The retort is again closed and a three per cent. solution of zinc chloride is forced in by a solution pump until the pressure stands at 100 pounds per square inch. This forces the zinc into the cells of the tissue and almost entirely replaces the sap of the wood. The absorption is very rapid, and the final process generally requires from three to four hours. Four-tenths of a pound of zinc chloride is injected into each pound of wood. The total time required varies from seven hours on pine to ten hours on Oregon fir.

The average life of a railroad tie is four years, and it is claimed that ties treated by this method will last from ten to twelve years. As zinc chloride is soluble in water, after ties have been in the ground eight or ten years it is found that the upper portion has lost practically one half its zinc, while in the lower portion there has been a corresponding increase. The cost of the process is about 12 cents for each ordinary railroad tie—about one-third of the original cost of the tie, while 200 per cent. is added to its life.

The Future Flying Machine.

M. Santos-Dumont says that he will supply his future airships with inclined planes, whose surface, added to that of the envelope of the balloon, will act in union with it under the propulsive action of the screw in supporting the weight of the mechanism. The airship which he expects to use in London will have such inclined planes. He hopes, therefore, gradually to approximate to the flying machine proper by reducing the volume of hydrogen until it is done away with altogether. The airship will then become an aëroplane in the absolute sense of the word. M. Santos-Dumont expected to have three new ships ready at a not distant date. He says that an airship of the length of the steamer Deutschland, constructed with the proportions of his No. 6, would transport a thousand voyagers, with a sufficiently powerful motor and the necessary amount of petroleum, from New York to Havre in two days. He thinks that within a few years such voyages will have become an accomplished fact.

Thick Bed of Sea Raised.

The master of an incoming steamship, in making soundings about thirty miles from the jetties, Gulf of Mexico, reports a strange phenomenon. The line showed twenty fathoms when there should have been at least sixty. The captain reported this strange shoaling to the government officials, and it was made the subject of a special report to the Navy Department at Washington.

The discovery led to a thorough survey of the bottom, by order of the government, to ascertain the cause of the remarkable shoaling which puzzled the commander of the steamship. It is believed to be impossible that the sediment of the Mississippi river could have been carried so far out—miles away at sea—and in such immense quantities as to reduce the depth of water from sixty fathoms, the depth observed some years ago, to twenty and twenty-five fathoms. The most tenable theory is that the bed of the sea was raised by some volcanic disturbance.

New Electric Railway Device.

A unique invention provides for the operation of street cars without the aid of electric motors as they are now made. Small electric magnets are embedded between the rails of the tracks and what corresponds to the armature is placed lengthwise on the bottom of the car. The current is supplied to the electric magnets buried in the earth, which, by their attraction to the magnet in the car, combine to help the car along. The current is, of course, interrupted in the ground magnets by an automatic switch on the car. The inventor claims a great saving of electricity, stating that 75 amperes with the usual pressure will suffice for 40 cars, while the present trolley cars require 75 amperes for each one. Recently, a 10 foot model car, accommodating six people, was successfully manipulated on a track 150 feet long.

Sleep by Compressing Arteries.

The Revue Scientifique, No. 6, Vol. 18, describes the Javanese method of inducing sleep by compressing the carotids, the large arteries that send blood to the brain and are situated in the side of the neck, running down from below the ear and inclining towards the lower front of the neck. The operator presses these with a hand on each side of the neck. Thus the flow of blood to the brain is lessened.

FOREIGN NOTES.

A recent number received of the Revue Scientifique, Vol. 18, No. 4, has the following among other notes:

M. Jean Maumus ligatured the end of the appendix vermiformis of monkeys. Dissection, after 22 days, showed that nature was defending the menaced organ by circumscribing adherences and encystment, by muscular hypertrophy, and by sending many macrophages to the seat of disturbance.

M. Lannelongue finds that the perforation of the appendix is not a new disease, for the last hundred years. Indeed, he found the appearance of it in an Egyptian mummy dating about 5,000 years ago.

M. H. Soulie has examined 3,097 Culex mosquitoes from Algiers and vicinity and finds no evidence that this genus propagates the malarial microbe.

M. Bachaus, of the agricultural institute of Koenigsburg university, has made numerous experiments in feeding cows on different vegetable food, and concludes that the flavor of milk depends more on the peculiarities of the animal than on the vegetables eaten.

In the Revue de Psychiatre, M. Prevès tabulates the percentage of persons who have transverse markings on finger-nails; he found that normal persons have only 10 per cent. while degenerates of all sorts have from four to seven times that amount. The belief of the translator of this item is that it often depends on temporary physical conditions unknown, for at times he has had many of these markings, and at other times, as now, none whatever.

Photography

PHOTOGRAPHY THEN AND NOW.

BY NEWTON W. EMMONS.

How very different are the conditions under which amateurs work now to what was the case a dozen years ago! At that time the transparent celluloid film such as is used so much to-day was unknown, the only flexible film available being a species of bromide paper, prepared by means of a rapid emulsion which, after developing, fixing, washing and drying, had to be made semi-transparent by rubbing with castor oil or vaseline and then passing a hot iron over it to make the oil penetrate the pores of the paper. As may well be imagined printing from such a negative required bright sunny weather and was slow work at the best.

In the line of cameras, about the only kinds available were the regular tripod camera and a "box" hand camera usually spoken of as a "detective camera." Both these types were bulky and heavy and are not to be compared with the neat, light and compact instruments, such as are made to-day. In the point of cost, too, there is considerable difference in favor of the modern camera.

The lenses of those days were neither so good, nor so cheap as they are now. The tele-photo and those made from the new Jena glass, which cover the plate sharply to the edges, with a large opening, were unknown. The developers also from which the tyro had to choose were few in number and confined for the most part to pyro, ferrous-oxalate and hydrochinon. Every amateur had to weigh out his own chemicals and make up his own solutions.

In the matter of printing papers we had not much of a choice as, with the exception of the regular bromide paper, such as that supplied by Eastman, they were all of the "printing out" variety. The one most generally used was the old albumen paper which, in order to obtain the best results, had to be sensitized by the user, and was only capable of producing a very limited variety of tones. It goes without saying that the prevalent style of finishing a print was to give it the highest gloss possible and to mount on a card with a very narrow margin.

In the early nineties the thin rollable celluloid film was first introduced and was soon followed by the "Kodak" camera, whose advent seems to have marked a new era in photography. Amateurs rapidly increased in numbers after the introduction of this camera and film, and their ever increasing demand for something new gave great impetus to the production of cameras and supplies. The Eastman Co. then came out with their now famous Kodak advertisement "You press the button and we will do the rest," which had the effect of bringing large numbers of recruits to the ranks of the amateur photographic army.

New styles of hand and view cameras were constantly being placed on the market, each one claiming some advantage over its predecessor. New kinds of lenses were produced which were more rapid and gave better definition than the older kinds. New plates were introduced, some of which gave more correct rendering of color values, while others were capable of photographing interiors facing window, and gave negatives free from halation, while still others were much more sensitive than anything previously produced. The number of new developers discovered and placed before the public was added to at the rate of from two to four a year, each new one claiming to be the ideal developer. New papers both of the printing-out and development varieties were produced in large numbers and were capable of giving almost any shade of black, brown, sepia, red and blue tones. New styles of mounts were produced which showed off the superior artistic merits of the matt papers to such an extent that the glossy print is slowly becoming a thing of the past.

The result of all these improvements is that a person may, for a comparatively few dollars, purchase a camera of the "press the button" type, and without any previous knowledge of photography, may sally forth and make exposure after exposure with a reasonable assurance of getting a fair percentage of presentable photographs.

But it is the more serious amateur who reaps the full benefit of the improvements that have been made in recent years. He has now at his service such a choice of cameras, lenses, developers, printing papers, etc., that he is enabled to produce pictures which would, a dozen years ago, have been deemed beyond the power of photography.

The tyro who at the present day takes up photography, with the intention of making himself a master of the art, has aids which students in the eighties had to do without. The text books available for his instruction are now numbered by the dozens, while ten years ago they could almost all be named on the fingers of one's hands. And the important question of exposure is simplified for him by the invention of several excellent "exposure meters," the intelligent use of which will ensure good negatives from at least ninety per cent. of the plates exposed.

All the different pieces of apparatus used by the modern amateur have been vastly improved in many ways, and many new developers are now obtainable which will produce excellent negatives free from all stains and discolorations of the film, such as were produced by "pyro." And if he do not care to weigh out his own chemicals for mixing the various solutions, he can buy them in "powder" or "cartridge" form, when all he has to do is to dissolve the contents of the "powder" or "cartridge" in a given quantity of water and the solution is ready for immediate use. This convenience was quite unknown in my salad days.

LONGFELLOW'S BIRTHPLACE.

The choice of printing papers is now extensive. If the aspiring artist have but little spare time during the daylight, he still finds at his service many excellent papers of the development class, which are capable of producing very artistic and pleasing pictures at night, using gas or lamplight as the source of illumination and in finishing of which a "dark room" is not necessary. These papers will give varying shades of black, brown and sepia by direct development and can be toned to produce shades of blue, green and red. There is, moreover, a great variety of printing-out papers for daylight printing to choose from, which are capable of giving many pleasing tones; and the different styles, colors, textures, sizes and designs of cards on which to mount his picture may be numbered by the hundred as compared with the few dozens available in past times.

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BENEFITS OF EDUCATION.

The practical men, or those whose lot in life requires them to engage in manual labor for a living, find it hard to see the benefits derived from the study of entomology, archæology, biology, or even grammar or English literature. For what has grammar got to do with building fences? Or English literature with hoeing potatoes? One is often asked similar questions by those who seem to think that a little knowledge of reading, writing and arithmetic is all that is required to make a success in life. Many persons lose sight of the fact that the advanced state of our present day civilization is due entirely to scientific knowledge, and the ability to put that knowledge to practical use. Says the Chicago American in a plea for more and better public schools: The ignorant man who has succeeded through natural force and lucky opportunity is fond of asking these questions:

What is the good of education? Of what practical use is scientific training?

These men are admirably answered by Herbert Spencer, to whose work they are referred.

A collection of Englishmen ruined themselves in the sinking of mines in search of coal. They might have saved their money had they known that a certain fossil which they dug up in abundance, belongs to a geological stratum below which no coal is ever found. They went on digging cheerfully and wasting their money. An acquaintance with that fossil and its meaning would have saved their cash.

The study of biology is essential in the successful fattening of cattle.

An "entozoon" seems to the practical man a foolish, imaginary creature. But millions of sheep have been saved by the discovery that one of these fancy scientific entozoa, pressing on the brain, caused the sheep's death. When you know the entozoon you can dig him out and save the sheep's life.

"My son's going to be an artist," says one proud father. "He does not need to study a lot of scientific rubbish."

This parent does not know that the difference between a good and a bad sculptor or painter is often based on knowledge or ignorance of anatomy and mechanical principles.

Education is important to the individual because it means the development of the brain, development of capacity for education, and increased chances of success.

Education is important to the state, because it means not only competent citizens, but moral citizens.

The animal in us yields to the influence of education. Kindness and brutality are enemies. They do not dwell together. The most important institutions in the country are the public schools, the gymnasiums of human brains. The most important citizens of the nation are the teachers. The greatest criminals are the employers of child labor, because they deny education, cut down in childhood the citizen's chance of progress and success.

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THE HEAVENS FOR OCTOBER.

BY PROF. MALCOLM McNEILL.

The Constellations.—Ursa Major is in the north below the pole, and Cassiopeia is high up in the northeast near the zenith. Auriga is not far above the horizon in the northeast. Andromeda is high up in the east and Perseus is between it and Auriga. The zodiacal constellations visible, counting from east to west are,—Taurus rising a little north of the east point, then Aries and Pisces just east of the south meridian, Aquarius just west of the meridian, then Capricorn, and finally Sagittarius setting in the southwest. Pegasus is high up just south of the zenith, and Aquilla high up in the southwest. Cygnus is west of the zenith while Lyra and Hercules are below with Corona and Bootes setting in the northwest.

Phases of the Moon, Eastern time:

New Moon.	Oct.	1, 12 h. 9 m. P.M.
First Quarter,	"	9, 12 h. 21 m. P.M.
Full Moon,	"	17, 1 h. 1 m. A.M.
Last Quarter,	"	23, 5 h. 58 m. P M.
New Moon,	"	31, 3 h. 14 m. A M.

There will be two eclipses during the month. The first is an eclipse of the moon, and the circumstances are good for visibility throughout the United States. It occurs on the night of October 16–17, and totality will last about an hour and a half. The middle of the eclipse comes just three minutes after midnight, central time, or three minutes after one o'clock, eastern time. As the eclipse is caused by the moon going into the cone of shadow of the earth, it can be seen at practically the same moment of absolute time from any station on the earth where the moon is above the horizon. Our use of standard time makes a knowledge of longitude unnecessary, except so far as it tells us what standard time we are to use at the place of observation, for such a phenomenon as a lunar eclipse; but it makes more trouble in predicting such a phenomenon as the time of rising or setting of any of the heavenly bodies, as such phenomena are first computed for local time, and the times must be corrected for the difference between standard and local.

The second eclipse is an eclipse of the sun on the last day of the month. It is a partial eclipse and will not be visible in the United States, but it will be throughout almost the whole of Europe and Asia, except the extreme southern portions.

Mercury, at the beginning of the month, is an evening star, but too near the sun to be seen, as it sets about three-quarters of an hour after sunset. It rapidly approaches the sun, and passes inferior conjunction with it on October 19, becoming a morning star. It then rapidly recedes from the sun and runs relatively northward, so that by the end of the month it rises about an hour and a half before sunrise, and is in good position for naked eye observation.

Venus is still a morning star, but it is rapidly drawing nearer the sun in their common eastward motion. On October 1 it rises about an hour and a quarter before sunrise; and at the end of the month the interval is only a little more than half an hour. Still the planet is so much brighter than the others that it will be possible to see it on any clear morning during the month until nearly the close.

Mars is still a morning star, but is falling behind the sun in their common eastward motion, and consequently rises earlier and earlier. On Oct. 1 it rises shortly before two o'clock, and at a little after one at the end of the month. It moves 16° eastward and southward through the constellation Leo, and on Oct. 20 it passes about one degree north of Regulus, the brightest star in the constellation. It is beginning to gain in brightness, but as yet the process is rather a slow one.

Jupiter is still in fine position for evening view in the southwestern sky. It remains above the horizon until about 1 A.M. on Oct. 1, and until about 11 P.M. on Oct. 31. It is in the constellation Capricorn, and moves a little westward until Oct. 4. Then for the rest of the month its motion is eastward, but it is quite slow, only a little more than one degree during the month.

Saturn is also in the southwestern sky in the evening; but it is farther west than Jupiter and sets more than a hour earlier. It is on the border line between Capricorn and Sagittarius, and moves about one degree eastward. Jupiter and Saturn have reached their closest approach and now begin to separate.

Uranus is also in the southwest in the evening, but still lower than the other planets. At the end of the month it sets at about seven o'clock, and throughout the month it is too low after sunset to be seen easily without a telescope.

Neptune rises late in the evening. It is in the western part of Gemini.

Hall's Journal of Health

FOUNDED BY DR. W. W. HALL 1854

VENTILATION OF MIDDLE-CLASS DWELLINGS.

BY FRED. T. HODGSON.

III.

What is the best methods of ventilating a house without making one of artificial power or expensive apparatus?

This is a difficult question to answer, as environment has much to do with ventilation. However, a few suggestions in this direction may not be out of place. As before stated, one of the best means of ventilation, is open-window ventilation, and the best windows for the purpose are those known as double-hung windows; that is, windows having sashes both top and bottom portions hung and balanced with cords and weights in such a manner that either the upper or lower sash can be opened at will. By this arrangement the upper sash can be lowered to any distance suited to the requirements, for the exit of exhausted air. The lower sash can be raised for admission of fresh air to suit. It is better, where it can be done, to lower the sash of one window and raise the sash of another window situated in an opposite wall, or in a wall at right angles to the first. This insures a current of air in the room, and purifies the atmosphere much more quickly than if both opened windows were situated in one wall.

As a rule, the opening of the lower sash causes a draught of more or less velocity, which is not only uncomfortable, but often dangerous to delicate constitutions; and in order to prevent inconvenience from this source, a method has been devised by which the current of air is forced upwards to a height above the breathing zone of the inmates of the room.

This device consists of a light frame, say 18 inches or more in width, and the full length of the distance between the window jambs inside the room. This frame may be made of such kind of wood as will harmonize with the woodwork of the room, the material being not more than two inches wide, and of such a thickness as will answer the purpose. The "stiles" or end pieces must run up above the top rail, from two to three inches, and may be ornamented from the rail to the jamb, or left plain as may be desired. Holes must be bored through these projections, for screws, so that the frame can be attached to the window jambs with suitable screws in a loose manner. The sides or ends of this frame, and the bottom must be fitted pretty closely to the jambs and window stool, but not so tight as to prevent the frame from being swung easily on the screws which act as pivots.

When nicely fitted in place and finished like woodwork in the room, the opening in the frame may be covered with silk or other suitable material, shirred, or otherwise ornamented, to suit the taste. When the frame is dropped in place, the lower sash may be raised, and the current will rush in, and striking the silk screen will be forced upwards, entering the room in a vertical stream on a line with the window, thus preventing a horizontal draught.

Should the room need "airing" when unoccupied, the lower sash may be raised and the screen lifted up or swung on its pivots, until the bottom of the frame rests against the sash above. This will allow the air to flow into the room in large volume on a line with the window sill.

Screens of this sort may be made a means of decoration, and if well handled add much to the appearance of a room. In one house one was made of ornamental stained glass instead of textile materials, and the effect is quite pleasing. Rooms having open fire-places in them, are, nearly in all cases, well ventilated, but, fires should be made in them at least four times a year, as flues sometimes get foul, and on a cold damp day, bad air may be forced from the flue into the room.

When ventilating flues are built in the walls or chimneys, they should not be parged with mortar. Warm air currents dry even the best mortar parging to dust, which is brought into the room with the air. Glazed pipes or tiles on the inside are good, the joints being made good and smooth with Portland cement. Large flues or ducts may be rendered in Portland cement to a smooth hard face with the angles rounded, when the best results will be obtained.

The manner in which a house is heated has much to do with the ventilation, and wherever it is possible, when radiators are used, they should be placed in the window recesses, or under windows where there are no recesses. This will prove very effective in preventing the cold arising from large areas of glass in cold weather, from chilling the air in the room. Provisions for the admission of pure air from the outside, may be made near the radiator, that will not visibly affect the temperature of the room.

Stove-pipe holes in chimneys to which no heater is attached, may be used to good purpose as ventilators, but they should be properly cleaned before being used for that purpose, and it is a good idea to burn a newspaper in the flue once in a while, to purify it. It should be closed at the entrance to the room, by an adjustable register—many styles of which are in the market—so that it can be closed when desirable.

Grape Juice.

Unfermented grape juice would be a very valuable and legitimate food provided it were made without the use of injurious preservatives. The University of California experiment station has issued a bulletin giving directions for preparing the juice in an unobjectionable way. This depends on killing the bacteria naturally present in the fresh juice, by heating to about 176° F. Heat below this point does not kill all the germs, while much higher heat injures the flavor of the juice.

The bulletin throws some light on the now almost universal practice of putting injurious preservatives in all sorts of preserved food products. Some samples of fruit juice which were sold as "pure, unfermented grape juice" and recommended for throat and lung troubles, were found on analysis to contain as high as 4 per cent. of salicylic acid, or more than 20 times what would have sufficed to preserve it. In some cases the alleged "unfermented" juice contained as much as 2 per cent. of alcohol. The bulletin says that the sample recommended for throat and lung troubles contained enough sulphurous acid to cause such troubles even in a healthy person.

Ice and Health.

While it is true that some bacteria survive exposure to freezing temperatures, such conditions, especially if prolonged, are highly unfavorable to bacterial life. Water tends to purify itself by freezing, but the purification is usually incomplete. A few bacteria may survive even after long exposure to low temperature. Hence too much reliance must not be placed on the purification of water by freezing, especially if the ice is artificially made. The practical lesson is not to mix ice with food or to put it in drinks. A temperature of between 50 and 60 degrees F. is sufficiently low to be refreshing, and to obtain this degree of cooling it is sufficient to place vessels containing the food, etc., in ordinary cold storage.

The Cause of Sleep.

What produces the feeling of sleepiness has long been a study with physiologists. Dr. Raphael Dubois, a Frenchman, has lately come to the conclusion that sleep is not necessarily the result of the exhaustion of bodily power and the need of sleep. It is the direct result of carbonic acid gas formed in the system, indirectly by work done, or otherwise.

During your waking hours you are producing in your body an excess of carbonic acid, by the oxidation of food, etc. This carbonic acid is an anesthetic, and in turn it tends to hinder oxidation and ultimately produce sleep. It is therefore a wisely-provided automatic regulator of waste in the human system, for it forces you to sleep before you have drawn dangerously on your reserve resources.

Dr. Dubois's theory is verified by the fact that even when you take carbonic acid into the system from an outside source you develop all the symptoms of fatigue, and finally go to sleep, though in fact you may not be fatigued. When you are in a crowded, close room, where there is an excess of carbonic acid in the air, you soon become sleepy and feel tired out, though in fact the carbonic acid, by diluting the oxygen of the air, has reduced oxidation in the body instead of increasing it.

Snails as Food

The popularity of the snail as an article of food is not confined to Paris, but extends throughout southern Europe and some parts of Africa. Dr. Edrard, a French writer, in a pamphlet, says that 90,000 pounds of snails are sent daily to Paris from the gardens at Poitou, Burgundy, Champagne and Provence. Those reared in gardens are fed on aromatic herbs to improve their flavor. Their market price is from 2 francs 50 centimes a hundred, while those from the hedges, woods and forest bring only 2 francs to 2 francs 50 centimes. The proprietor of one snailery in the vicinity of Dijon nets over 7 000 francs annually. The snail is reared and fattened with great care in some cantons of Switzerland as an article of luxury, and is exported in a pickled state. It is also eaten as a relish and nutritious article of food in Austria, Spain, Italy, and in some parts of the United States. The Ashantees and other African tribes smoke them and eat them as daily food all the year round. In Algeria, in the markets, large heaps of snails are sold by the bushel and the hundred as an article of food. Vendors hawk them in the streets of Cairo. In modern Rome fresh-gathered snails are hawked by women from door to door.

Weight of Brains.

M. Marchand has investigated the brains of 1,173 persons immediately after death. The weight of the brain is influenced by the disease; diphtheria, for example, increases the weight. The brains of new-born boys weigh, on the average, 371 grams; of new-born girls 361. At the end of the first year, the figures are boys, 967; girls, 893. By the end of the third year the weight of the brain has tripled and from this epoch it increases very slowly, especially with girls. It attains its greatest weight at about 19½ years for men, at about 17 for women. The average weight of the brain of an adult male is 1,400 grams; of an adult female, 1,275 grams. The reduction of weight due to senile atrophy commences with men, about the eightieth year; with women, about the seventieth. We may recall for comparison, the following facts: The heaviest brain on record is that of the novelist Tourgenieff (2,120 grams); one of the lightest is that of Gambetta (1,160 grams). The weight of the brain is, thus, one factor, and only one, in the comparison of different men and of different sexes.

Largest Pearl.

A pearl, supposed to be the largest and most valuable in the world, has been found near Broome, West Australia. Its value is estimated at between $45,000 and $75,000.

Correspondence

Indian Bowl Remains.

Editor POPULAR SCIENCE NEWS:

Several years since, while hunting relics on Noraconk's Island, in the West Branch river, Northumberland County, Pa., I came very unexpectedly upon a buried bowl. I say unexpected—but why should we use the word when all finds by the collector are unexpected ones? I merely mean to say I did not think any pottery, outside of shreds, would or could be found after the lapse of one hundred and fifty years since aboriginal occupation. It had been buried one foot or more below the surface, or at least deep enough to escape contact with the plow, for the ground had been farmed for years.

About one hundred yards south of the wagon bridge, on east side of island, and in direct path of a new channel being cut by the river, I noticed several pieces of pottery sticking out from a slight mound perhaps two feet across Investigation showed that a bowl had been buried and that it was crushed either by the load of waters or by something striking it on the upper side. Some parts crumbled to the touch, and others were evidently washed away. What its contents had been, if any, could not be ascertained.

This bowl was quite large.—the inside of the neck, below the rim, being about eight inches, while the outside diameter across the flaring rim is in the neighborhood of eleven inches, and the broadest section of the bowl over twelve inches. The clay of this bowl was tempered with powdered quartz and bluish flint—principally the latter. The inside is colored black and at one point extends over the rim and continues down on the side. The thickness (about three-eighths inch) varies some, but on the whole is quite regular. The ornamentation is entirely on the outside, and consists of parallel strokes and lines made with a blunt piece of wood, and laid on at different angles around the rim and neck. On the body of the bowl proper a piece of fine woven matting, apparently, had been pressed, also at different angles, while the clay was yet soft. On one portion of the neck the thumb nail was evidently used to make a few marks.

Surrounding the bowl were nine pit or hammer stones—one, of oblong shape, having two pits on each side. These were likely buried with the bowl, as several were still imbedded in the soil.

A heavy shower coming up prevented me taking all the data I wished of this find, and obliged me to leave all the pit stones. In my hurry, too, I think I dropped some pieces of the bowl. Through force of circumstances I was unable to return for some time, and when I did, was chagrined to find the pit stones had disappeared, although I was careful to place them under a pile of drift—while the plow had removed all traces of the site of the bowl.

Less than two years ago I again came upon the remains of another bowl which had been disturbed while grading for the electric road between Milton and Lewisburg. The shreds in this case were too much scattered and broken to permit of much data being taken, but it serves to show that we may even yet find pottery in a fair state of preservation.

J. W. VAN KIRK.

The Cocoa Confusion.

Editor POPULAR SCIENCE NEWS:

Noticing that a recent issue of an agricultural journal in attempting to elucidate the deplorable confusion of the words *cocoa*, *cacao* and *coca* succeeded only in making the matter worse, I offer herewith a concise statement of the facts:

COCOA—is the term applied to the oilless preparation of chocolate; it is the name in the British West Indies for cacao; it is from the palm that produces cocoanuts.

CACAO—is the Spanish-American name of the plants (Theobroma cacao and T. pentagona) which produce the chocolate seeds; this word is fortunately superceding "cocoa" as applied to the plant and its seeds; it is pronounced kah-*kah*-oh.

COCA—is the English name of a South American shrub (Erythroxylon coca); its leaves contain the famous alkaloid cocaine and have strongly stimulating qualities.

To avoid this confusion the obsolescent word broma might be revived to take the place of cocoa the oilless, powdered preparation of chocolate; and cocoa, the plant, should certainly be called either cacao or chocolate; which leaves cocoa for the old name of the palm. There is no reason why the two other words should get confused. For the sake of those who may care to roam around the subject, it might be added that:

COCA of Mexico—is the white ipecacuanha (Richardsonia scabra), a common drug.

COCO—is the Spanish-American (and Brazilian) name for cocoanut.

COCOS—is the botanical genus to which the cocoanut (C. nucifera) belongs.

COCOE—is the name applied in the British West Indies to the roots of Colocasia antiquorum esculentum; the Spanish name is "ajautia," and the Hawaiian, "taro."

COCO—the wood of a tree (Inga vera) used in shading coffee, and called in Spanish-America, "guaba."

COCUS—is a West Indian cabinet wood.

COCOITE—is the Mexican name for a tree used to shade cacao.

CHOCHO—is the vegetable pear (Sechium edule) of the Southern States and Tropical America.

CAUCHO—is the Tropical American name for raw rubber.

CAUTO—is glass-bark tree (Hirtella silicea).

CACOONS—is Entada scandens, a vine whose very large seeds are sometimes made into boxes.

COCOA PLUM—is Chrysobalanus icaco, a West Indian shrub and its yellow or purple plum-like fruit.

ICACO—is the Spanish-American name of the cocoa plum.

COLA—is a tree (Sterculia [Cola] acuminata) related to the cacao shrub; it produces the famous kola nuts which yield the cola preparations.

So much without leaving the subject of botany.

O. W. BARRETT.

Self-Surgery of Crabs.

Editor POPULAR SCIENCE NEWS:

Remarkable experiments on decapitated crabs have been published, showing, as in many other instances, that intelligence is simulated by reflex action of nerves,—in this case, sensations going only to the spinal cord and thence reflected by motor nerves; hence the word "reflex."

Self-mutilation is practised by crabs to relieve themselves from the incumbrance of injured joints and limbs. The wounded crab uses his claws (on the injured side) to pull off or cut off the offending member. The act has all the signs of a premeditated act. It appears to be intelligent, voluntary. The action is itself complex and deliberate; the results to the crab are useful. But the action is certainly a reflex action, having nothing to do with the brain. It takes place even when the brain is destroyed, With some crustacea it takes place even when the animal has been decapitated. The claws, in such a case, seek the wounded member and tear it off just as before. Wounds in members that are not articulated (as in the small legs of the hermit crab) do not excite the reflex act. The wound itself is not the exciting cause, therefore. Cut one of the walking legs—for which the reflex exists—on the hither side of the articulation, not as before on the further side, and there will be no action. This is very curious, because identically the same nerve has been cut in both cases. The muscles certainly play a part in the phenomenon. Autotomy involves certain special muscles. If they are injured the action cannot occur.

In a set of experiments these muscles were first injured. After this the leg could no longer serve for locomotion; but the crab made no effort to seize the leg and to tear it off, which indicates that the reflex was not excited. But so soon as the leg was cut beyond the autotomic articulation the animal used his claws in violent efforts to free himself from the wounded member. The reflex acted. In other experiments the autotomic muscles were first injured and then the nerve cut on this side of the articulation. No action.

How are such facts to be explained? Are they the results of pure reflexes? Most certainly—since they occur when there can be no question of the intelligence. But, in appearance, these reflexes are most intelligent. The most enlightened intelligence could do no better. The study of such phenomena as have been described is, then, of the first importance and deserves the attention of physiologists.

SOL.

Arawak Drawings.

Editor POPULAR SCIENCE NEWS:

So far as I can learn, the only known rock carvings in Porto Rico, are those near Rio Blanco, in the district of Humacao. The site is a long gorge containing three cascades of the River Hicaco, just above its junction with the River Blanco. The figures are cut into large syenite boulders in the bed of or along the sides of the stream. There are some fifty carvings still visible, many of which, however, are nearly effaced by attrition during freshets. With few exceptions the human figures are incomplete and elementary.

There is one well preserved drawing, apparently of a chief, with mantle and head dress. Another evidently represented an animal, the dog, probably; although the face is of the same type, the ears are pointed and set on top of the head. The gravure lines are about half an inch deep, and rather broad in proportion.

A portion of a human skull was found at a depth of three feet during excavation work in the vicinity. It is very probable that investigation would disclose burial sites, implements, etc. This site was very likely the headquarters of the tribe of the eastern half of the island; it is six miles from the sea—beyond the reach of the pirate Caribs—at the head of a small but very fertile valley surrounded on three sides by impassable mountains.

O. W. BARRETT.

Effect of Water on Pollen.

Editor POPULAR SCIENCE NEWS:

While examining the pollen of different wild flowers, I thought I would try the effect of water upon same, not expecting to find it would have any influence upon it. Placing some of the pollen of wild geranium on the slide of my small microscope, I added a drop of water. The pollen took readily to the liquid and began floating merrily about; just then I was called away for a couple of minutes, and when I returned to my desk I looked through the glass at the pollen which I fully expected to find sailing about as I left it; what was my surprise to find the grains completely surrounded by a cloudy mass, and perfectly still!

I cleaned the slide, put on fresh pollen, added fresh water, and watched developments. The grains began sailing about as before, but I noticed at the same time they began to swell slightly, and put forth three little points at equal distances apart, changing the shape of the grain from round to a triangular form. Suddenly they began one by one to burst from the under side, sending forth a cloudy substance like spores. The bursting began after the pollen had been in the water about two minutes. The riper the pollen grains, the sooner they burst.

I tried the pollen of several other plants in water, and found the same peculiarity with all ripe pollen grains taking readily to water. The pollen of mandrake would not mix, and the water had no influence on it that I could see. I have never heard of this circumstance before, and would like any information regarding it through your columns.

B. A. LEWIS.

Steam Rising from Crater Lake.

Editor POPULAR SCIENCE NEWS:

Parties who have just reached Portland, Oregon, from the famous Crater Lake, report that great clouds of steam were seen rising from the waters, while they were encamped upon the shores.

Crater Lake is situated in the heart of the Cascade range, in Klamath county, southeastern Oregon. Countless years ago Mount Magawa was an active volcano; so geologists have decided.

Finally, the whole interior of the mountain collapsed, forming an immense elliptical basin thousands of feet deep. Only the outer rim of the mountain near its base was left. In time the volcano ceased, the fires were extinguished and the colossal basin filled with water, thus creating Crater Lake. The lake is about seven miles long and 3½ wide. Great butting cliffs tower aloft above the lake's surface, rising in places 2,000 feet high. Soundings show the lake to be 2,700 feet in the deepest place.

No visible stream empties into this lake, though it must be fed by hidden springs. Rogue river rises in Crater Lake. This lake is one of the most wonderful bodies on the American continent, and is visited annually by many hundreds of tourists and sightseers. The party that were visiting the lake positively assert that great white clouds of steam were seen to rise from the lake and hover over its bosom. The waters also seemed strangely perturbed at times. Great public interest is felt and expressed in the startling report.

Crater Lake and the craters of Mounts Pelee and Soufriere before their eruption, as can be seen by a comparison of photographs, are very similar. At one time of the year all that portion of the mountains occupied by Crater Lake is uninhabitable, the winter's snow being yet almost too deep to admit hunters and camping parties—the only persons who now visit the lake.

J. MAYNE BALTIMORE.

First Wireless Telegraph Line.

Probably the first wireless telegraph line in this country to start on a commercial basis, is that between Whites Point, Calif., and Catalina island, 36 miles off the coast, which has just opened for business.

Questions and Answers

QUESTIONS NOT ANSWERED.

Answers are solicited, especially for all questions so far without replies. Questions will appear but twice, successively. The following questions need reply—366, 371-378, 383.

395. The Malarial Microbe. Have any of your readers seen a description of this? Is it a bacterium, bacillus, or micrococcus?
Janet.

396. Canna Insect. What is the adult appearance of the insect that bores into the stem of cannas? The caterpillar found is about an inch in length, dark brown, with light dorsal line and light broad lateral stripe on the last four or five segments. The true legs and 4th, 5th, and 6th segments are dark. Gardener.

397. Geranium Insect. Can any one of your readers name the caterpillar, slender, about 1¼ inches long, found eating a geranium leaf, and precisely imitating the stem of the leaf, as it stands out straight at an angle with the stem? Gardener.

398. English Book Binding. Why is it that English cloth-bound books have the cover attached only by flimsy cheese-cloth instead of by twine? The covers soon break off, and it is exasperating. With this I put another question: What is the sense of the recent fad of rough-edged book leaves, as vexatious as uncut leaves?
Reader.

399. Blackberries. Why is it that blackberries grow to perfection in size and pulpiness only in partial shade?
G. W. M.

400. Insects in Wet Seasons. Are the young larvæ drowned out in wet seasons? There is certainly a great reduction in numbers as compared with dry seasons?
Observer.

401. Plantain Seeds. Who can beat this?—an average vigorous plantain (Plantago major) with 25 spikes, and 8,070 little pods, each of which contains "7 to 16 seeds?" Say eleven ovules, and it would be 88 770 seeds. No wonder this weed prevails. An inch was cut from an average spike, the pods (generally called seeds) counted, and multiplied by the 270 inches of spikes Observer.

402. Brilliancy of Sun. What is the cause of the greater brilliancy of the morning sunlight as compared with that of the evening? The sun's rays penetrate the same amount of atmosphere in ascending to the meridian, as in descending from meridian to horizon. The presence of dust, mist, or smoke will not explain it, since the light of morning in all circumstances seems keener, fresher, than that of evening which is more yellow and fire-like.
A. H.

403. Blacksnakes and Mice. Is not a blacksnake a good substitute for a cat? We found one in our cellar and have not sought to kill him. No evidence of mice has been noticed since his snakeship made his appearance. Country.

404. Sunflowers of various size. One of mine has flowers five or six inches in diameter of disk, at top, down to one inch on lower side stems. Is this common, and do the varieties of sunflowers of all sizes originate in this way? I know that there are species in nature of varying size, some very small, but I speak of the numerous sorts of the cultivated. Janet

405. Japanese Hydrangea Colors. My H. paniculata grandiflora is turning a brownish green, this Sept. 6th. Will any one who is long familiar with this plant inform me if it is due to a wet season,—the change having been to red for several drier seasons. Also, does the humid summer account for the browning and falling of many Paulownia leaves, probably from a fungus? Janet.

406. Horses and Heat. When a horse is hitched in the street, exposed to a hot sun for hours, ready for immediate use, does he not suffer more in health and comfort than if he were in a stable; and in which of the two situations is he most annoyed by flies? This inquiry is to settle a dispute. Observer.

407. Boiling Potatoes. Is anything gained by violent boiling? Can the water and steam in an open vessel be raised above 212° Fahr. C. J

408. Studies in Drawing. What published series of trees and animals are available and most useful in the practice of drawing? Texas.

409. Tarnished Silver. Why does plated ware turn to all colors of the rainbow when standing long without polishing?
M.

410. Old Exposed Paint. Why does this become lighter in color, whatever the original color may be? M.

411. Fruit Abundance. To what may the excessive abundance of fruit this year be attributed, e. g., berries and grapes?
Suburb.

412. Grapes and Jelly. Is it known generally that green grapes, even half grown, make good jelly, and that, by so using them, the superabundant fruit can be thinned out, so that what remains will ripen better and larger? Suburb.

413. Dangers of Football. Should not the piling of the players on each other in a heap be prohibited by law, or be reason for arrest under some existing law that concerns disorder or assault? I have repeatedly seen persons injured in this way; sometimes death results. A. T. F.

414. Asthmatic Breathing. If every disease has a remedy, what is the remedy for asthmatic breathing accompanied by palpitation, shortness of breath and extreme exhaustion on slight exercise? K.

415. Hot-Air Balloons. 1. What is the lifting capacity of ordinary hot air type per cubic yard? 2. At what temperature are they inflated? 3. What would be the cost of such a balloon (silk envelope) large enough to lift 400 lbs., exclusive of its own weight? 4. Using kerosene oil to furnish heat, how much would be required to inflate the balloon and how long would it remain afloat? 5. Aside from fire are there any disadvantages peculiar to hot-air balloons? 6. What is the relative heat producing value of kerosene, gasoline and alcohol? Homer W. Jackson.

ANSWERS.

387. Pink Clover. In answer to G. J.'s question, I will say that the pink clover is without doubt Trifolium hybridum, Alsiche or Alsatian clover, which is becoming fairly common. A description of it will be found in Grey's Manual of Botany.
Charles C. Plitt.

390. Peat for Fuel. It is largely so used in other countries. The recent high price of coal is already leading to the use of peat in this country. Men are now digging it a half a mile from where I live on Long Island. There is plenty of peaty bog in the eastern states. Peat is good simply as cut and dried, and better as mixed with something of a tarry nature and compressed. I would suggest that it might be profitable to chop finely by machinery anything of a vegetable sort—brush, weeds, weedy grass, waste boards and scraps—and compress it with enough adhesive. Sawdust, of which vast piles accumulate at mills, has been so prepared for fuel. Ingleside.

393. Freckles. These can be removed by means known to any doctor, or advertised by dermatologists. I do not believe in the quack advertisement talk referring everything to "impure blood;" nor do I believe in vegetarianism as a cure-all. As to freckles they come mostly by exposure to the sun, no doubt, and no persons are healthier than the freckled street boys and farmers' boys. Sun-Spot.

393. Freckles. I beg to differ with Timothy Wheeler in regards to freckles. They are caused by exposure to the sun's rays, and are found in greatest abundance on the exposed parts of country children possessing delicate thin skins. They are due to a collection of pigment in the cells of the rete malpighii. To prevent or remove them, protect the skin from the sun and reduce the amount of iron in the food. Freckles are not due to poor blood.
John Howard, M.D.

394. Insomnia. Keep youself in as good a humor as possible, rise at an early hour, take enough exercise to make you moderately tired. In some cases with certain people, insomnia ceases if they rise from their beds and walk about the room for a little while. When sleeplessness is caused by heat, it is a good idea to take a cold bath before going to bed. If the feet or hands are too warm, bathe them in vinegar and water. A healthy body, a good digestion, and sufficient exercise is the best guarantee of profound slumber.
O. P. H.

395. The Malarial Microbe. It is reported as "Bacillus malaria." The bacilli are rod-like,—hence the name, from the Latin bacillum, a little stick or staff; and bacterium means the same thing, from the Greek bacterion. Micrococcus is from the Greek, meaning little berry (koklos,) and applies to microbes that are cell-like, little dots instead of rods in form, a variety of bacteria. All are vegetal, and not Hæckel's Protista. Doctor.

396. Canna Insect. In reply to Gardener, I have one of the larva from a canna, but now for a long time he seems to defer his pupa stage, and keeps on boring and eating the pieces of canna stem which I renew for him. Apparently, so far, he contemplates getting into the ground to pupate over winter. Will supply him with some earth, to see if that is his intention. W. P.

397. Geranium Insect. I have reared one of these geometrid fellows, taken from a geranium,—otherwise called a looper or measuring worm. At rest, they adhere by the last two pair of "prop-legs," and stand out like stems of the plant. This fellow ensconced himself under a dry leaf, and came forth a thin-winged moth, buff-yellow with large irregular blotch across the middle of the wings and numerous spots, all these markings a purplish-brown. In the large quarto volume of the Geometridæ, by Prof. A. S. Packard —a government publication with plates— this species could be identified readily, I presume. The pupa shell is transparent with two very eye-like black spots where eyes might be, but of course are not. R. B.

398. English Bookbinding. There is no imaginable reason for it. Substantial work is supposed to characterize the British; but these cheese-cloth book hinges. with no cords, are the extreme of utter flimsiness. I have a lot of such books with the backs loose. As to rough-edged leaves, particularly the purposely ragged ones, it is a pure affectation of something ancient, probably,—one of the foolish fads of all sorts, such as old-style lettering, or the big fireplaces and andirons originally designed for log fires, but now, with coal fires, a monkey imitation without reason. Why do not the occupants of these houses wear jack-boots and trunk-hose? G.

398. English Bookbinding. I have heard it said that the English who are rich enough to buy any books, are supposed to be rich enough to have these re-bound in fancy leather in some style that each one adopts for his library. It is a compliment then to all the buyers to assume that they are wealthy, with a fancy for re-binding of some sort. For one, I contemn that kind of compliment; I am not a Dives. Slimpurse.

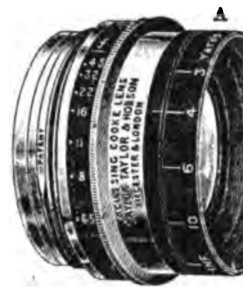
402. Brilliancy of the Sun. The reason would seem to be obvious. The air accumulates dust and smoke during the day, which settles during the night, giving a clearer sunlight at morning. L. M.

Current Mention

A New Way of Focussing.

Every photographer knows that he cannot focus at one time objects at widely various distances from his camera. If the lens is fixed at that separation from the sensitive plate which suits a distant object, it must be moved further from the plate to focus a near object. It is for this reason that cameras are generally provided with bellows or other means of varying their length.

Sometimes, however, to simplify camera and shutter construction the lens is fixed at one separation from the sensitive film, and near objects are brought into correct focus by means of "supplementary magnifiers" suited to those distances. This method of focussing, while it simplifies camera construction, has the disadvantage of being applicable only to those distances of object for which magnifiers are provided. The focussing Cooke lenses, which are a development of the well known Cooke lens, provide a means of focussing objects at any distance within their range, while they themselves are kept at one fixed distance from the sensitive plate.



FOCUSSING COOKE LENS.

The figure shows a focussing Cooke lens in which the requisite movement of the front glass is effected by partly rotating the ring A, which has engraved upon it a scale of distances of object. The finest effects of definition which modern anastigmats can yield are seldom obtained in hand cameras of ordinary construction, owing to the want of rigidity and truth of the lens supports. This improvement, which results in the rigid fixing of the lens, is, from this point of view alone, especially valuable. Attention is also called to the fact that these lenses, by rendering bellows and slides unnecessary, effect a considerable reduction in the cost and weight of cameras.—Eng. Mech.

Color Cure for the Eyes.

In the present state of society, with the forced conditions of living, when the strain of competition inclines more particularly to educational pursuits, it is most essential that the sense of sight should be properly understood. Too much of one color not only tires the sight, but absolutely impairs it, and the constant application of the eyesight to one grade of color reduces it in a very short time to a condition of atrophy, which is variously described as color blindness, weak sight, etc.

The invention of a rainbow-hued card proceeds on approved scientific lines. It is based on the theory of the solar spectrum, as indicated by the foremost scientist of the day, Lord Kelvin. It affords relief in a thoroughly scientific manner. The eye, which craves for constant change of hue, can, in the momentary glance which colors afford, travel the whole length of the spectrum, and receive an acquisition of strength far superior to any aid concocted by spectacle or other eye-strain specialists. Besides being the cure for weak eyesight, this is a capital preservative and ocular tonic. A glance over this colored card is equal to a walk through green fields and beneath sunny skies. It concentrates for a busy man as much ocular refreshment as his wearied eye requires, and is so unconventional that, placed once on his desk, to be effective, it only requires occasional glancing at.—Eng. Mech.

A Tree-Dwelling Kangaroo.

Bennett's tree kangaroo (Dendrolagus bennettianus), of which a specimen has lately been received at the Zoological Gardens, was first exhibited by the society in 1894. It is a native of Queensland. It is extremely probable, writes our zoological correspondent, that the tree kangaroos, of which there are four or five species, are specially modified types which have taken to an arboreal life.

The chief point of distinction between the tree kangaroos and the other members of the family is in the normal proportions of the two pairs of limbs to the body, the length of the hind ones being only slightly in excess of that of the front pair. In the hind feet the second and third toes have claws nearly as large as the others. The tail is of great length and thickly furred; although it is not prehensile, it is of considerable use to the animal when climbing. It is stated that this kangaroo prefers a particular kind of tree, and that in the rainy season it keeps to the lower branches. —Pall Mall Gazette.

A Blue Rose.

Mr. M'Donald, an American rosarian, has just brought to notice a blue rose, of which he is himself the cultivator. Extreme precautions were taken to protect the specimen from perils of the sea and salt water, etc., and to keep it fresh and vigorous, it being protected in a specially-fitted, beautifully-worked miniature greenhouse, something like a bird cage in shape. As a result, on arriving in Liverpool, the buds were found to be in splendid condition. Mr. M'Donald will exhibit the specimen at the horticultural shows.

A Device for Alarm from Coffin.

Count Karnic-Karnici, a chamberlain of the Czar, has invented a hermetically sealed iron box which is placed on the grave. A hollow, removable tube connects it with the coffin. Inside the tube is a spring. One end of the spring is connected with the iron box. To the other end inside the coffin is affixed a glass ball which just touches the chest of the body.

The faintest movement of the ball, such as the simple motion of breathing if the dead come to life, sets the spring in motion. Then the lid of the iron box springs open and a flag rises out of it four feet above the ground. At the same time an alarm bell rings from the box and an electric lamp shines out of it. These signals are intended to serve equally well by day or night.

When the box lid rises the tube admits to the coffin sufficient air for breathing and the light from the electric lamp shines through it. The tube also serves for a speaking tube. The box, being sealed unless giving an alarm, allows no gas to escape. It cannot be opened from the outside; only by pressure from within the coffin.

◆

Solder for Aluminum.

Recent reports state that William H. Whitney, of Clark University, has invented a solder for aluminum that gives astonishing results.

All that Mr. Whitney will say about his invention is that he has perfected it to a certain degree and that the solder he has used is sound and practical. He has used it in instrument making and is using it at Clark University. The solder is applied with an iron, as in ordinary work of the kind.

The solder can be used both in joining aluminum plates and in uniting separate pieces of wire. The latter has been the harder problem of the two heretofore, and is exceptionally valuable to manufacturers of aluminum, as it enables the wire to be used in great lengths and makes it available for long-distance telegraph or telephone work.

Members of the faculty of Clark University have made practical tests of the strength of the solder. Mr. Whitney has made joints and allowed two men to attempt their separation with pincers. The joints have lasted longer than the aluminum itself.

◆

Submarine Photography.

Submarine photography is not likely to become a popular pastime, but it is leading us into unknown regions, and M. Louis Boutan, who began by investigating the animal life of the waters, has become an enthusiastic sea bottom camerist. He has lately published some of his remarkable photographs of submarine scenery. He uses a hand camera, which is enclosed in a tight copper box, having a te-glass window, and is mounted on a cost-iron tripod. Suitable mechanism is provided to expose and change the plates. The pressure of the water, inconveniently great even at twenty or thirty feet, was an early difficulty, but this was counteracted by means of a rubber ball, holding about a gallon, from which air was forcod through a tube into the box as the pressure is increased. Light fades rapidly in sinking below the surface, daylight exposures being impracticable at a depth of twenty-five feet. Magnesium powder is burned in oxygen in a suitable glass globe, and by this powerful illumination instantaneous exposures are made with interesting results.

◆

Passenger Air Ship.

A despatch from Paris quotes Santos-Dumont as saying that he has begun the construction of an airship which will be a a reply to those critics who contend that such a vehicle can have no practical value or utility. The new vesssel will be a combination of a airship, such as his own models have made familiar, and an aëroplane machine It will be provided with inclined planes arranged on the right and left and at the back and front, so as to insure perfect stability. The balloon will contain 1,500 cubic metres, and the motor will be an engine of forty five horse power. The vessel will be able to carry eight persons, and it is M. Dumont's intention to establish with it a regular passenger service. He says that he anticipates no difficulty in getting people to patronize it.

◆

Pin-Hole Spectacles.

By making a hole through a piece of paper or postcard with a pin, moving the pin a few times round the hole to give it a smooth edge, holding the pin-hole close to the eye, and looking at printed or other matter held at the normal reading distance, there is perfect definition, and anyone who requires to use glases to read can with this device read anything. When a pin-hole is held to both eyes at the same time, there is a great improvement over one, with perfect binocular effect The field of view is much smaller than that seen when glasses are used. There is less light and no magnification. The importance and utility of this simple device in many circumstances is obvious.

◆

Largest Known Tree.

What undoubtedly is the largest known tree in the world has been recently discovered two and a half miles from the Sanger Lumber Company's mill at Converse Basin, far up in the Sierras, in California. The discovery was made by a party of hunters. The monster was measured six feet from the ground and it took a line 154 feet and 8 inches long to encircle it, making it over 51 feet in diameter. This tree is a few rods from the company's boundary line and is on the government reserve, hence it will escape the woodman's axe.

Eros Rediscovered.

Eros, one of the small planets or asteroids of the solar system, was rediscovered August 2, by Prof. G. J. Ling, operating the big telescope in Chamberlin Observatory.

Eros is one of the most recently discovered of the chain of asteroids. Its presence in the heavens was first detected by an impression on a photographic plate exposed by Witt at Berlin in 1898. A year ago last October the planet came close enough to the earth to be observed optically and was visible for observation until June of last year, when it again became invisible. Its reappearance has been awaited with interest by astronomers on account of variations in its brightness reported by various observers.

BOOK NOTICES.

Talks to Students on the Art of Study. By Frank Cramer Cloth, pp. 309. The Hoffman-Edwards Co., San Francisco. This is the most "common-sense" work on psychology that it has been our pleasure to read. It is not intended as a text book, rather to furnish effective suggestion to the student while the mental powers are plastic, but on the point of setting. A perusal of this book puts one on his mettle; it makes one almost shudder to think of the pitfall that awaits the one who is careless in his observation, is inattentive, or does not concentrate his mind upon his daily task, or the work put before him; his goal will be failure. The book proceeds on the assumption that a student can profitably give steady attention to his own activities while his intellect is maturing. It is written in the belief that youth can contribute largely to its own intellectual training, and is intended to furnish effective suggestion to the student while he is passing through the critical period of his intellectual life. Some of the subjects treated in the twenty-two chapters are: The Law of habit; Interest; Attention; Observation; Discrimination; Memory; Reasoning; Reflection. This work is highly valuable to the student, for it gives him advice when he needs it most, and its being so admirably written, it is extremely interesting at the same time, which insures its being finished if once begun. "Talks to Students" should have a large sale, and ought to be placed in every school and college library.

Neither Bond Nor Free. A Plea. By G. Langthorne Pryor. Pp. 239. New York: J. S. Ogilvie Publishing Company. A negro problem novel, which goes far to show the many-sided character of the race, and shows observation of sympathy of no common sort. The author pleads for justice in the case of the negro accused of crime, and deprecates communities taking the law in its own hands and administering justice without legal formalities.

CHILDHOOD.

Sickness takes the grown person back to childhood in the matter of diet.

In sickness, the first move is to cut off all the more solid articles of diet and return to milk and gruels.

The needs of the sick are the needs of the growing child. Strength is lost, flesh is lost, and a return of these means health.

The remarkable way in which Scott's Emulsion restores the strength and flesh that have been lost by sickness makes it an ideal method of getting sick folks out of bed and onto their feet.

Send for free sample.

SCOTT & BOWNE, Chemists, 409 Pearl St., N. Y.

Crude Oil for Fuel.

A new form of burner for the consumption of crude oil is that of H. A. House. The oil burners were attached to an 80-horse-power flue boiler and easily kept up the normal steam pressure of from 75 to 80 pounds, burning steadily and noiselessly and without smoke or odor. All this was accomplished with an economy of fuel, one pint of crude oil being being used for each horse-power hour.

The petroleum supplied to the burners was from the Beaumont fields in Texas, a crude fuel containing from 10 to 20 per cent. of asphalt and heavy oil, which is non combustible. Mr. House has solved a double problem with his burner. The crude oil is generated into a gas for consumption, the asphalt being distilled simultaneously and conducted to a receiving reservoir. The asphalt by-product is worth nearly $3 a barrel, while the crude oil is worth about 10c. a barrel in Texas.

By use of these burners, which the inventor has planned for use in every purpose, from the dwelling house furnace up to the large manufactory, locomotive or steamship, Mr. House believes the oil will become a universal fuel along the southern belt.

It is asserted that the new burner can be left burning unattended, that it is self-starting, self-cleaning, self-adjusting and self-lighting, when the blaze for a moment has been put out, accidentally or intentionally. The flow of the oil is regulated automatically by the steam pressure. When the pressure rises the oil supply is shut down until the normal heat is again attained. In this way an economy of fuel is assured. The burners are to be tested thoroughly here and then are to be introduced in Texas, where the field of their greatest development is said by their inventor to await them.

Our Magazine Clubbing Offers For the Season of ...1902-3

As a great many of our readers took advantage of our clubbing offers last year, we again offer POPULAR SCIENCE NEWS in connection with several leading magazines at greatly reduced rates. While last year subscriptions to Popular Science News and Review of Reviews were required to be new, the following offers apply to **either new or renewal subscriptions.**

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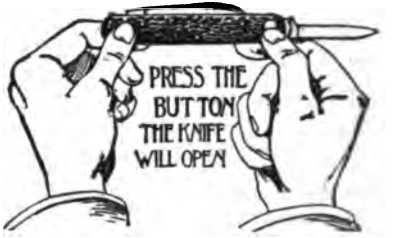
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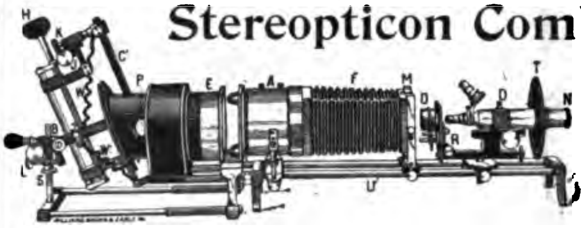

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POPULAR SCIENCE NEWS

DEVOTED TO THE STUDY OF NATURE AND RECENT PROGRESS IN THE FIELD OF SCIENCE.

From life by A. Hyatt Verrill.

Notes on a Well-Known Songster

By A. HYATT VERRILL.

THROUGHOUT the eastern states, wherever brushy pasture or brambly thicket afford a suitable home, the catbird dwells. From the first warm days of earliest spring, until the frosty autumn mornings skim the woodland pools with a delicate shimmer of ice, he is in evidence. In the early morning and late afternoon, his loud musical song, which for variety and richness rivals that of the Mockingbird, is poured forth from fence-post or tree top, while during the day his queer feline "meow" greets each and every intruder on his domains. Sociable in disposition, attractive in appearance, with his odd voice and well-developed intellect, it is a wonder his habits and economic value are so little known or studied. Many a farmer will tell you that he robs the granaries and commits depradations on fruit and berries. Moreover, the black character given him by the rustics is further augmented by many persons who aver that he destroys and devours the eggs and young of other birds.

Suppose he does occasionally help himself to the farmers' plentiful stores, must we forget the fact that he raises on an average 12 young each year, the hungry mouths of which be keeps constantly supplied with caterpillars, grubs and other insects, which would do the farmers' crops far greater injury than all the catbirds of the neighborhood? As to his destroying bird homes, I can never believe him guilty. Often a catbird will build her nest and raise her brood close to that of some small warbler or sparrow, but in such cases I never knew of the neighbor's nest being disturbed. Moreover, they seem tender-hearted creatures, and are the first to show anxiety when the cry of a young or wounded bird is heard. Let us give them the benefit of the doubt until their actual guilt is proven, and even then may there not be outlaws and criminals with perverted tastes and instincts in birdland as well as elsewhere?

Unlike most birds these little gray chaps seem to reason, and really have a knowing expression that is lacking in many species. On one occasion I endeavored to secure some photographs of a catbird feeding her young. The camera, as usual, was set up and focussed on the nest and was partially concealed by means of branches and a green cloth. This matter arranged, I retired a short distance, and bulb in hand, awaited the mother catbird's return. Presently, bearing a fat green caterpillar, she flitted up, but instantly her bright beady eyes discovered the camera. Cocking her head on one side she eyed it suspiciously, complaining meanwhile in a low tone and hopping about uneasily. At last, with a quick flirt of tail and wings, she sprang to the edge of her home, and ere I could spring the shutter, had dropped the morsel to her babies and was out of sight among the leaves. In a few moments I heard her complaining notes in the thicket and soon she reappeared with her mate. Both birds hopped about, chattering to each other, eyeing the camera, and evidently discussing the danger lurking therein. Finally the father darted up to within a few inches of the lens, "meowing" defiantly and fluffing up his feathers, apparently challenging the queer contrivance to do its worst. After a few moments of this (during which his wife looked on approvingly), he seemed satisfied as to the instrument's harmless character, and with contempt expressed in every feature, perched upon the lens-board and twittered a few low notes of satisfaction. Satisfied that they had nothing to fear, both birds at once fell to work to feed their neglected babes, hurrying back and forth with insect tidbits, and paying not the least attention to the camera. As soon as I had made an exposure, it was necessary for me to approach the instrument to replace the slide and insert another plate. Much to my surprise, when I did so, the busy parents showed not the least alarm at my presence, evidently thinking that I was in some way connected with the camera, and therefore harmless. In this way I was able to obtain a number of excellent photographs of the old birds at their domestic duties.

"AS SHE PERCHED ON THE STUBBED-OUT TOE."

The catbird's bump of curiosity is remarkably developed, and any odd or peculiar thing will invariably be investigated, once they are satisfied it is harmless. I well remember how amused I was in watching a catbird engaged in solving the mystery of an old shoe, caught on a barbed wire fence near a clump of barberry bushes. She would alight beside it, peer inside, peck inquisitively at its many rents, retire to the seclusion of the barberries, scold a few seconds, return to the discarded footgear and repeat the performance. So intent was she upon solving the mystery of the queer affair, that she was entirely indifferent to my proximity, and as, gathering courage, she perched upon the stubbed-out toe, and with head on one side studied the mysteries of the shoemaker's art, I took her portrait. As the sharp click of the shutter aroused her from her contemplation, she darted off with remonstrating voice, but her curious thirst for knowledge was still unsatisfied, and a few days later I noticed her, again striving to solve the problem of the unknown.

"IN HER PORCELAIN BATH TUB"

"MEOWING DEFIANTLY AND CHALLENGING IT TO DO ITS WORST."

Living and breeding close to haunts of man, these birds soon learn what to avoid and of what to take advantage. Where undisturbed, they become very tame, building their nests and laying their deep, blue-green eggs in dooryard shrubbery and porch-covering vines, and hopping about kitchen door and poultry-yard,—almost as much at home as members of the domestic flock. On one occasion I knew a pair of these birds to build in a honeysuckle close to the dining-room window, and regularly after each meal, the neighborly couple would enter the room, hopping about the floor or even venturing on tables and chairs,—gleaning many a scrap and crumb to satisfy their dainty appetites.

Perhaps it is this association with mankind that causes them to make use so readily of human inventions. Scraps of rags or carpet, as well as string and tough paper, they find are more enduring and easily manipulated than sticks and leaves for nest building, while a watering-trough or rain barrel is a more reliable source of drinking water than that of the wayside puddle.

Quite recently, while driving along a suburban road I noticed a catbird preening her wet plumage in a brush pile by the roadside. Evidently she had just completed her morning's ablutions, and curious to learn where she had found any water (for I knew of none in the vicinity), I stopped to investigate. Beside the brush was a collection of old rubbish,—broken crockery, old bottles and empty tins,—and among the other trash was a discarded dish half filled with water from the last rain. The following morning ere daylight, I visited the spot and waited for my little bather to appear. At last she came, accompanied by her husband, and, while she fluttered about in her porcelain bath-tub, he watched her lovingly from a nearby twig, regaling her with bits of song and stopping now and then to arrange some rumpled feather in his smooth, gray costume, while awaiting his turn.

Animal Life

THE FLORIDA GOPHER.

BY C. E. PLEAS

Next to the Box turtle, which shuts his doors against his enemies, I think the gopher (a name elsewhere applied to other animals) the most interesting of our turtles, not because it furnishes, or used to furnish, the famous terrapin of the east, but because of its modest and peculiar life. They are most harmless creatures, never on the offensive or defensive, except perhaps, to take an occasional mess of greens from our gardens, being entirely herbivorous.

FLORIDA "GOPHER."

Much hunted for shipping and home consumption, they are becoming scarcer from year to year, and apparently shun human habitations, but the fact is they have been "caught out" except in the sand hills and more isolated places, and unless some protective measure is brought to bear, one more southern curiosity will be a thing of the past.

The few that remain of the gopher now live in colonies, on the highest sandy knolls that are least frequented by man. Sometimes as many as a dozen burrows will be found on one hillside. The method of digging these holes is peculiar. The dirt is scratched loose with one forepaw at a time (a rather quick motion for so sluggish an animal), and at the same time the opposite hind foot slowly shoves the dirt back with a very mechanical motion. Presently the turtle shifts to the other side and works with the other feet. These holes are usually twelve to fifteen feet in length and about five feet beneath the surface, and of just sufficient size for the occupant to enter.

Like the hermit crab, the gopher is obliged to seek new quarters occasionally, and as to whether they always dig new houses I cannot say, but I do know that holes which have remained vacant for months are sometimes reoccupied. The shell of a mature specimen is ten inches long by eight broad and five inches thick, and is easily indented by thumb and fingers. The color is various shades of yellow and brown blended together.

The methods of catching them are various. Some dig them out, some snare them by placing a loop over the opening at night, while others hook them out with pole and metal hook on end, and I've heard parties tell of rolling heated stones, etc., down the holes and running them out. But the most cruel of all is to pile them in barrels and boxes by wagon loads and leave them in the roasting sun, on docks, etc., for weeks at a time, waiting for shipment.

AN UNEXPECTED METAMORPHOSIS.

BY ARTHUR J. SNYDER.

One Saturday afternoon as were returning from a walk into the country, a common Polyphemus cocoon was seen hanging from a hazel twig. The cocoon was carefully separated from the twig and with other trophies of the outing brought home, and finally placed upon the study table that the children might be interested in watching the moth emerge in the spring.

One day during the winter, baby was seeking something with which to amuse herself while all the big people were busy for a moment. Having climbed upon the table, she found the cocoon and thought it a nice plaything. She tried to bite it, but found the silken covering too strong, so dropped it upon the floor, where it was afterward found with one end so badly crushed that all supposed the inmate killed, until, one evening, as the members of the family were gathered about the table reading, a slight scratching sound was heard and the cocoon began to wriggle about. The children were delighted, for now they were sure that there was life within.

During the long winter evenings, amusement was furnished by its "kicking," as they called it, and by its rolling about from side to side of the table They even wondered how far it had traveled on account of the strange movements of the pupa within. "Surely the moth is very much alive and anxious to get out of its prison," someone frequently remarked.

One day Mrs. Snyder came into the study just in time to see, tumbling from a small opening in one end of the cocoon and hurrying away as fast as they could travel, fourteen ugly white grubs. She quickly captured them with a stick—they were too unpleasant in appearance to handle—and placed them in a glass jar that we might see them on returning from school. It was now evident what had caused the remarkable movements of the cocoon during the winter evenings.

Within three days, each of these grubs had changed into queer, brown, oval-shaped objects, much like a seed, and gave no evidence of life. Thus they remained, plain brown, uninteresting objects, until one morning in March, when we found several flies flitting about in the jar. On examination, we found that the pupa cases had little lids at one end and that these had opened from within, and from them the flies had escaped.

In a few days, fourteen flies had come out of the fourteen pupa cases and were anxious to fly away just as the artist, Mr. G. Wesley Browning, has represented them in the accompanying picture.

Thus it is that the collector is sometimes surprised as well as disappointed on finding that a supposed perfect cocoon is infested by some parasite, which in due time emerges, instead of the beautiful specimen which was expected. And it is in this way that Mother Nature preserves the balance in her kingdom, and provides a means of preventing certain species of insects becoming too numerous.

POLYPHEMUS COCOON FOSTERING FLIES.

Temperature of Insects.

A Russian experimenter, using the thermo-electric pile, reports this, which may be useful in destroying injurious insects. When the air is very moist the insect's temperature may rise more rapidly than that of the air. When the insect begins to move, its temperature rises and continues to rise until the motion ceases. This rise of temperature continues till at about 38° C. (102.2° F.) a heat paralysis sets in. The paralysis is only temporary; it ceases as the temperature falls once more. Below —0.5° C. (31° F.) the insects are entirely without motion. The temperature must, in general, be raised to 12° C. (53 6° F.) before the wings are moved. For one species, Saturnia pyri, the highest temperature compatible with life is 115° F, This is about the temperature that is fatal to vegetable life.

WAYS OF WASPS IN AUTUMN.

There are so many wasps, and so much is known about them, that all we shall try to do is to tell of their ways at this season of the year, and show how some clever, open-eyed people have found out what wasps will do in certain emergencies. You may be able to find out still more—only, be careful how you study a wasp. They are irritable creatures. You mustn't pry rudely into their daily lives; you mustn't take with them liberties of any kind and expect them to treat you with polite consideration. Studying wasps will teach you gentleness, great patience, and other good lessons; while the punishment for any mistake on your part will mean stings that hurt more than you can imagine. Have a care, then, how you study the wasps!

The true social wasps, as they are called, to distinguish them from the solitary wasps, live very much like the bees and the ants—in colonies. They are, indeed, better known than the solitary wasps; but we shall not say they are more interesting, because we have learned better.

The males and the queens are not developed until autumn, so that wasps have not a long time in which to do the immense amount of work they generally accomplish to fit out their homes. If the little busy bee improves each shining hour, the bigger, busier wasp seems to work as hard in bad weather as in fair. Wasp duties are divided in the following manner:

The wasp colony is started in the springtime by the queen. At the approach of winter, the male wasps and the workers die, but the females manage to crawl into protected places, under the bark of the trees or in the crevices of house walls, where they sleep the winter through. Then in the spring each modest little female wasp wakes to find herself a queen. Naturally, she thinks she would like a kingdom for her rule. But how does she find it? She must work. As a true queen should, she works so long as there's nobody to work for her. Queen Bee has never to do that. She starts in life quite differently. That is something for you to remember in studying and comparing the ways of bees and wasps.

Queen Wasp has to make the beds, to lay the eggs, and to take personal care of her immense family until they are grown. The first family that is hatched is composed entirely of workers—not a drone among them! They at once turn in to do their duty. All the time that they were helpless larvæ the queen fed them, but now they will not allow their mother to work. Her only duty is to lay the eggs. Although she built the first nest all by herself, the workers build all the other nests.

Sometimes the queen assists in taking care of the new broods of young, but the whole of the work is never again allowed to rest upon her. If you can find a large wasps' nest at this time of the year, you will see that the worker wasps are busy on the larger cells to hold the most important eggs—eggs that will produce the males, or drones, and the new queens; for the workers are all female wasps. The top combs of the nests contain the smaller cells; the lower combs, the larger. All the social wasps build from the top downward.

In a vineyard of Missouri, where the grape clusters were inclosed in paper bags by some clever human fingers with the intention to prevent the fruit's destruction by insects, the social wasps must have thought the damp and rotting paper bags perfectly adapted to their nest-building operations, and they thus used the paper already prepared rather than to take the unnecessary trouble of manufacturing their own wood-pulp paper. It is a curious thing that the wasps are the first paper-makers to use wood-pulp. They scrape the fibres from old fences, or the unpainted sides of houses, and so work it over with their saliva that it makes a pasty stuff from which they fashion nests.—Our Animal Friends.

Nitrogen from the Atmosphere.

The extraction of nitrogen from the atmosphere on a commercial basis, has long been a subject of study. In 1785, Priestley discovered that an electric spark determined a chemical change in the surrounding air. The Electrical Review reports the foundation of the Atmospheric Product Company in New York, which has established works at Niagara Falls for the manufacture of nitrogen on Priestley's principle. A large chamber containing dry and cold air is supplied with electric discharges of small quantity and high tension, and the discharges produce the chemical changes that result in gaseous oxides of nitrogen. The air from the chamber, so charged, is conducted to an absorption tower, where it comes into contact with the substance whose nitrate it is desired to obtain. If the air is carried into pure water, nitric acid results; if into caustic potash, saltpetre results; if into caustic soda, Chile saltpetre is the resultant product.

Indians Who Live on Clover.

There are some Indians in Mendocino County, Cal., that may not live "in clover," as we understand the phrase, but it is certain that they live on it. Strange to say, they make it a regular article of food, going out into the fields and pulling up the plant and eating it by handfuls—leaves, stems, flower-heads and all. These same Indians use many plants that white men find no value in, among them seaweeds, fungi, lichens, ferns and conifers. Some of these they use for their medicinal properties, others for the nutritious qualities of their seeds, and still others for their fibres.

Plant Life

FERNS OF THE PACIFIC COASTS.

BY DR. LORENZO GORDIN YATES.

Read at the session of the Pacific States Floral Congress, held in San Francisco, Cal., in 1901.

Ferns form a very distinct and attractive group of plants. They are familiar to all observers of natural objects from the beauty of their ample foliage, which is most commonly plume-like in form, of a fresh and vivid green hue, or cut into small leaflets or lobes. These, on close observation, are seen to be marked on the surface, or lightly sculptured, or embossed with delicate veining. Ferns exhibit all the grace and beauty resulting from finely-divided foliage, the various tints of green which rest the eye, the rich browns as an artistic contrast, and further contrasts of large, coarse-growing forms, to enhance the beauties of the more delicate and filmy species. Some resemble blades of grass, from which they can with difficulty be distinguished; others, creeping, unambitious vines, which carpet the soil in the shade of the forest trees, or cover the rough surface of rocks with a tapestry of nature's weaving.

The Gleichenias (pronounced Gli-ke-ne-as) climb over rocky surfaces, and among shrubs and undergrowth, supporting and protecting with their wiry stems the more fragile and delicate ferns and flowering plants from injuries, which might otherwise be inflicted upon them by the movement of animals, and by other causes. Others, more ambitious, climb among and over the shrubs and forest trees, while many of the smaller and more delicate species vie with the orchids in their endeavors to hide the rough bark and unsightly appearance of the fallen and decaying giants of the forest; and the tree ferns share with the palms in adding to the beauty and character of the scenery of the tropics. They vary in size from species in which an entire plant may be covered by a silver dime, to the tall, palm-like, arborescent species, which support their crowns of feathery fronds at a height of fifty or sixty feet.

It is generally supposed that ferns are restricted to shady, moist places, such as woodland streams, shady banks, and dense, moist forests. While this in a measure is true, we find that they thrive under almost as many and varied conditions as do flowering plants. People, while in search of rest and amusement, seek such conditions as do the ferns most often found and best known. The warm, humid atmosphere of islands, like the West Indies, the Hawaiian group, and the South Sea Islands, seems peculiarly adapted to the best development of ferns, the conditions being somewhat of the nature of the atmospheric condition of the

Carboniferous Period of the world's geological history. Tropical regions where not too arid, produce ferns in the greatest profusion. Different genera of ferns require different conditions to enable them to thrive; some, like our Woodwardias, grow in or near running streams, while Pellæas are often found at their best on sunny hill slopes, among rocks.

The Cheilanthes and Notholænas grow at higher altitudes than most of our native species, but generally in the shade of rocks or trees, or in crevices. The filmy Adiantums grow best under the spray of falling water. Polypodiums prefer to grow on the trunks and limbs of trees, or on rocks, where there is sufficient moisture in the atmosphere. Some prefer the shady barrens of pine forests, notably the Schizæa pusilla of New Jersey, while others, such as Aspidiums and Aspleniums, require the damp, rich humus under stately trees of the forests. Acrostichum aureum and some other ferns grow like reeds or bamboo in marshy swamps. The Vittaria makes its home in the tops of the palmetto trees, and resembles a bunch of grass much more than a fern. Lygodiums, or Climbing Ferns, require rich, damp soil, or moist, decayed bogs, which they cover with their dainty sprays, or, climbing the tallest trees in the forest, clothe them with a network of lace-like foliage.

In the island of Jamaica and similar localities, many ferns are epiphytal, attaching themselves to the surface or bark of the trunk and branches of forest trees, covering them with a mantle of living green. The most curious of all is the Floating Fern (Ceratopteris thalictrioides), which requires no soil, no anchorage, but simply floats upon the surface of streams and quiet pools in southern Florida, and other tropical countries. It is singular in another respect, being one of the very few ferns that are annuals; the other annuals are Gymnogramme chærophylla and G. leptophylla.

The nobility and stateliness of the fern family culminates in the tree fern, whose magnificent crowns are reared aloft on their straight, slender stems, which, being of a fibrous character and easily penetrated by the roots of other plants, become the homes of many delicate species of the smaller ferns, selaginellas, orchids, etc. In fact, there is scarcely a place from which ferns are entirely excluded. In the far north, and on lofty mountains above the limit of forests, the delicate Cystopteris, the firmer Polypodiums, and Aspidiums peep from the rocks or wave over alpine rivulets. The woods, ravines, and rocky dells of our eastern states are full of their beautiful forms. From the rocks hang graceful Adiantums, Cheilanthes and Aspleniums; while along the water courses and shady ravines are multitudes of Adiantums, Pteris, Woodwardias, Camptosorus, Osmundas, Onocleas, and Aspleniums.

On the Pacific coast, especially in Southern California, many of the species and some of the genera common to other portions of North America are absent, as our well defined dry season does not suit the moisture-loving species which grow in such luxuriance in more humid regions. The larger number of species of Cheilanthes, Pellæas, and Notholænas, several of which extend through Mexico, and some to South America, are perhaps more interesting to the fern lover than are the coarser and more rampant-growing ferns of more northerly regions.

The remarkable extent of the coast line of the United States on the Pacific, extending as it does from latitude 32½ degrees, to 72 degrees north, and between longitude 40 degrees and 187 degrees west from Washington, including all the coast from the semi-tropic region of northern Mexico to the extreme limit of Alaska, gives us a range of extremely varied climatic conditions, and numerous zones of animal and vegetable life; in consequence of which, our fern flora partakes of the characteristics of many widely separated regions.

A great many of the ferns of the southwest are really Mexican species which lap over and intermingle with those of more temperate and northern species. Several species of Cheilanthes and Notholænas are found in southern California, Arizona and New Mexico, but disappear with more or less rapidity as we leave the Mexican border. Occasionally patches of these southern species are found at widely separated localities, often at high altitudes, and their distribution is such as to give rise to the question, are these species in process of evolution or of extinction? But the comparatively recent appearance of man on the earth, and the still shorter time during which he has made a study of these subjects, is entirely insufficient to enable us to answer the question with any degree of satisfaction.

One of our Polypodiums (P. scouleri), has been noted from Martin County, north of San Francisco, which is perhaps its northern limit; next in San Francisco County, near the ocean; again, on an outlying islet in San Luis, Obispo County; and further south, on one of the Channel islands, off Santa Barbara, from which locality it skips to Gaudaloupe Island, off the coast of Mexico. It does not appear to have been found at any distance from the ocean. Is it the remnant of a species which formerly occupied a larger extent of country and is aproaching extinction? or has it been recently evolved, to become, in time, more generally distributed? Or is it a stray, or survival of the fern flora of territory which formerly existed to the westward of the present coast line? All of these theories have been advanced, but which, if any of them, is the correct answer to the question?

Nephrodium patens, found in Santa Barbara County, is found in Texas and Florida. Several other of our ferns present equally interesting illustrations of the peculiarities of distribution. Some of our species are restricted to California, and more of them to California and Oregon, and to California and Arizona, but as we go north we find the species of the eastern states overlapping and intermingling with the ferns of the Pacific coast, until we reach a region where the ferns common to Canada and the northern states predominate. One marked departure from the general rule in relation to the disappearance of the Cheilanthes in the north, is shown by Cheilanthes argentea, which is found in, and restricted to Alaska; Botrichium boreale is another species which is restricted to the same territory.

The Pacific fern flora represents a portion of the Nearctic realm, a term applied to the portion of North America lying north of Mexico. This realm is divided into five provinces, called Boreal, Medial, Occidental, Arizonan, and Austral. Each of these provinces possesses species peculiar to itself, but the limits are by no means sharply defined, for some of the species will pass beyond the limit, yet the majority found in one province are different from those in the others. This rule does not apply to the species which are cosmopolitan in their character.

Three of the above-named provinces, namely the Arizonan, Occidental, and Boreal, are represented on the Pacific coast. Of the political divisions of our coast line, California and Alaska alone appear to possess species peculiar to the territory lying within their boundaries. It is probable that when the large extent of territory forming the northwestern portion of the United States is more thoroughly explored, many new species will be discovered, and the known habitat of many others largely extended.

For decorative purposes ferns stand unrivalled, their graceful and delicate fronds causing them to be appreciated by all lovers of the beautiful. For the embellishment of the conservatory, dinner table, ball room, or the home, ferns present a beauty of outline which is never tiresome. For bouquets in connection with flowers they are indispensable. Woodwardia radicans, which in some parts of California, has fronds more than ten feet in height, is unrivalled for the decoration of walls and other purposes.

The first use to which nature put the ferns appears to have been the conservation of the superabundance of poisonous carbon dioxid from the atmosphere, thus gradually preparing it to sustain animal life, which was evolved at a later period. This carbon thus taken from the atmosphere and assimilated by the ferns and other cryptogams, was deposited in solid form and afterward covered and stored in nature's laboratory, where it was eventually changed to coal, petroleum, and other carbonaceous substances. From this storehouse, after the lapse of millions of years, it is being exhumed by civilized man, to supply the heat, light, and motive power necssary for his comfort.

Man uses ferns for various economical purposes. The pith of Cyathæa medularis (a tree fern) is used by the New Zealanders as food. The stipes (stems) of Pteris esculenta and Callipteris esculenta, and the tuberous roots of Nephrolepis tuberosa, have been used for food. Asplenium filixmas, Ceterach officinarum, Scolopendriums, and many others have been used medicinally. The styptic drugs brought from Sumatra under the names of Penghawa Djambi and Pakoe Kidang, are supposed to be products of ferns. The tomentum of the "Pulu plant" (Ciboteum) used in California and Australia, when feathers were not obtainable, to stuff pillows, cushions, and mattrasses, is no longer used, it being an unsatisfactory substitute for feathers. Gleichenia dichotoma is used by the negroes of Brazil for making pipe stems. Angiopteris and Polypodium phymatodes are used by the natives of the South Sea Islands in the preparation of cocoanut oil. The rhizomes of several species of ferns furnish food to the natives of Australia.

The medicinal qualities of some of the Adiantums have been highly extolled and recommended for the relief of persons suffering from pulmonary diseases, and in Mexico tea made from the Adiantum tricolepis is prescribed for chills and fever, under the name of "Silantrille de poze." Woodwardia radicans was used by the Indians of California for the treatment of bruises; it was used as an infusion taken internally; they called it "Golpe." The Spaniards learned its uses from the Indians, and called it "Yerba Golpe." In southern California the aborigines used our Aspidium rigidum argutum for medicinal purposes, and the stipes of the Adiantum in their basket-work. In Europe and other countries ferns are more generally utilized for various purposes than they are in the United States.

The true ferns of North America, north of Mexico, number about one hundred and fifty. Of these, fifty are found in California. Among them are eight Pellæas, eight Aspidiums, five Polypodiums, five or more Notholænas, three Adiantums, and eight or more Cheilanthes, besides Cryptogramme, Lomaria, Woodwardia, Aspleniums, Phegopteris, Woodsia, together with numerous varieties of the species of the above named genera, and species of the genera Ophioglossum and Botrichium, belonging to the Ophioglossaceæ. In Oregon and the regions further north there are perhaps fewer species. Those are more prolific, and consequently their presence is more noticeable. The real number of species can not be determined with certainty until the flora of those regions has been more thoroughly studied.

It is much to be regretted that many of our choicest ferns are in imminent danger of extermination from the recklessness or thoughtlessness of persons who seem to have an insatiate desire to pull up or destroy everything that is beautiful or rare. Picnic and camping parties will load up their vehicles with the delicate ferns and flowering plants, to be thrown away as soon as they begin to fade.

Our school-children should be taught to preserve, instead of destroying, our ferns and flowers.

Trees and Moss.

The time-honored rule that moss grows on the north side of a tree, a rule which forms part of every woodman's catechism, and which he would no more dispute than one of the Ten Commandments, has received a few sharp blows from Henry Kraemer, of Philadelphia. An investigation which he has conducted shows that on 10 per cent. of the trees which he examined moss grew on the west side; 10 per cent. on the northwest side; 20 per cent. on the northeast side; 35 per cent. on the east side; and 15 per cent. on the southeast side.

Origin of the Weeping-Willow.

The weeping-willow tree came to America through the medium of Alexander Pope, the poet, who planted a willow twig on the banks of the Thames, at his Twickenham villa. The twig came to him in a box of figs sent from Smyrna by a friend who had lost all in the South Sea Bubble and had gone to that distant land to recoup his fortunes. Harper's Encyclopaedia tells the story of the willow's arrival in America. A young British officer, who came to Boston with the army to crush the rebellion of the American colonies, brought with him a twig from Pope's now beautiful willow tree, intending to plant it in America when he should comfortably settle down on lands confiscated from the conquered Americans. The young officer, disappointed in these expectations, gave his willow twig, wrapped in oil-silk, to John Parke Custis, Mrs. Washington's son, who planted it on his Abingdon estate in Virginia. It thrived, and became the progenitor of all our willow trees.

To Send Mail at 248 Miles an Hour.

The Minister of Posts and Telegraphs, Signor Galimberti, and the leading officials of his department have examined a plan submitted by an engineer named Piscicelli for the establishment of a system of electrical delivery of mails, by which letters are to be transmitted in aluminum boxes along overhead wires at the rate of 248 miles an hour.

A commission has been appointed to report upon this system before instituting experiments between Rome and Naples.

Between these two points, the inventor claims, he can deliver letters in twenty-five minutes, while the time to send mail from Rome to Paris could be reduced to five hours.

Archaeology

Edited by WARREN K. MOOREHEAD, M. A.

GLACIAL KAME BURIALS IN OHIO.

BY WARREN K. MOOREHEAD.

[Read before Section H., Pittsburg meeting American Association.]

Throughout the state of Ohio, except in certain southern and eastern counties, bordering upon the Ohio river, there are many gravel knolls, gravel ridges and kindred formations deposited, so the geologists inform us, during the latter part of the glacial epoch. Sometimes these knolls stand isolated on the edge of a plain; frequently several of them exist on slightly rolling ground. Not unfrequently they are almost mound-like in contour, so much so that at first glance they seem to have been artificially formed; yet they are all natural,

From these ridges and hills, the farmers and county commissioners have taken immense quantities of gravel to be used in road construction. During the excavations, large numbers of skeletons have been found. Whether in the northern, western or southern counties, it matters not; the burials appear to have been general and present the same characteristics throughout the entire region.

These burials are pertinent. To say that they are all of later Indians is preposterous; that they have been hastily made is also erroneous. They constitute a problem in Ohio archæology and as such merit our study and consideration.

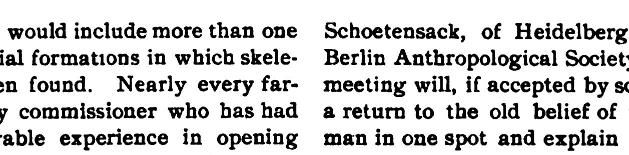
The antiquity of the burials is an unknown quantity. Whether they are 500 or 2,000 years old, it is impossible to state. The largest oak trees have been found growing over these graves.

The graves themselves are of simple construction. A pit, two or three feet in width and five and a half to seven feet in length, was dug. The depth varies from two feet to as much as six feet. The body was placed in a horizontal position, the arms at the sides, and the legs extended. I have examined fifty or sixty of the gravel graves, and have never found a burial made in any other manner. In Pickaway county, in Hardin county, and in Warren county, teamsters reported to me that they found, in gravel burials, the crania and the long bones placed in separate heaps. This is hearsay evidence and I simply mention it for what it is worth. The archæological map of the state of Ohio, owned by the Ohio State Archæological and Historical Society, shows some of these glacial kame interments. Careful inquiry among persons who have excavated in the tombs, fails to substantiate the presence of copper objects with any of these burials. As no archæologist has given the subject much attention, I may be wrong in stating that copper is not found with the burials. Future explorations will settle this and other questions. Some whole pottery, several carved shells and stone tubes, bone handles to flint knives, slate and sandstone tablets, and boat-shaped objects have been found.

In the southern Scioto valley long trenches filled with skeletons have been discovered, but this must not be confounded with groups of single graves. The trench burials—particularly those found near the sites of the Shawano towns in Ross and Pickaway counties, are manifestly modern.

ORNAMENT FROM MOUND BURIAL.

I may quote briefly from my preliminary report on the subject published six years ago. "With the exception of some pieces of pottery and carved shell, the most crude and primitive form of ornaments and weapons accompanied the skeletons. There is no care evinced in the preparation of the graves—no evidence of ceremonies having been enacted, such as we conclude were carried out when the graves were constructed. A simple excavation is made in the knoll and the bodies deposited, apparently without any wrappings of hides or cloth. When possible a rounded knoll—almost artificial in appearance—was always chosen. The number of interments ranges from one to fifty. In Clark, Pickaway, Licking, Clinton, Ross, and Hardin Counties, gravel burials seem most numerous. A circle twenty miles in diameter, with Circleville as the center, would include more than one hundred glacial formations in which skeletons have been found. Nearly every farmer or county commissioner who has had any considerable experience in opening pits, speaks of the finding of skeletons, always tolerably well preserved."


SHELL ORNAMENT, MOUND BURIAL.

Because of the preservation, the skeletons would interest the anatomist. Excellent preservation is not evidence of recent interment. The gravel surrounding them permits all moisture to percolate rapidly below the body and leave the bones entirely dry. Whether of infants or adults, the bones are invariably sound.

Were these people prior or subsequent to the mound-building tribes? A careful investigation may enable archæologists to solve this question. At present one must theorize—and that is not at all satisfactory.

The objects accompanying the remains are not to be classed with the objects accompanying mound burials. The bones, on their appearance, cannot be said with authority to be either old or recent. Theorizing, one might suggest that the first men in the Ohio valley made their burials on prominent points or elevations. Rather than construct mounds, they selected gravel knolls, for these were both conspicuous and easy of excavation.

Cannel coal ornaments have been found, also pendants and discs of shell. One of the shell ornaments, reduced in size, is herewith presented. No pearl beads, no ocean shells and no foreign substances other than cannel coal have been found, so far as my observations extend. Cannel coal outcrops at Flint Ridge, but whether Flint Ridge material in the form of projectile points and knives has been taken from the gravel burials, I am unable to state. At best the problem is a pretty one and merits serious study.

Man's Birthplace in Australia?

A startling theory brought by Professor Schoetensack, of Heidelberg, before the Berlin Anthropological Society at a recent meeting will, if accepted by science, cause a return to the old belief of the origin of man in one spot and explain the essential unity of the human race without regard to color. It is based on the reflection that during the geological ages when, in the evolution of mankind, the brain must have been developed in a creature comparatively feeble, there were wild beasts of marvelous strength and agility in whose domain so weak a race could not have maintained itself unless furnished with feet to outstrip its enemies. In America, Europe, Africa and Asia the manlike animal could not have survived unless a hoof had been developed at the expense of the other digits, as in horses or the two-toed quadrupeds.

The northern or southern extremities of the globle could not have been the cradle of the human race, says this theory, neither could any part of the globe where ferocious animals abounded. For in the former case the cold would have destroyed life before the brain was sufficiently developed to invent means of making fire; and in the latter, mankind would have been unable to exist in the face of his natural enemies, save in the trees. But if arboreal life could have allowed brain development, it would have still left man a four-handed instead of a two-handed being.

So we are forced to the supposition that these early stages were passed on an island free from carnivorous beasts, not far from the equator. But that could hardly have been a small island, since man would require more nourishment than so limited an area could afford. There would have to be a variety of a climate and surface and room for survival in one part when war, disease, or famines destroyed the inhabitants of another. There would have had to be almost a continent for this gradual development, with hills and deserts and smaller islands accessible where the human stock might survive ravages. Where, asks Professor Schoetensack, does such a continent exist?

The professor is of opinion that one locality, and only one, fulfils the requisite conditions; namely, Australia Here there are no large and dangerous carnivorous beasts, while the climate is temperate and equable, and so dry that fire may easily be made.—N. Y. Times.

Black Hills Explorations.

The German explorers are making new finds continually in the Black Hills, beyond Babylon. A recent excavation has unearthed a temple of a god of physicians.

The chemical examination of Babylonian copper and bronze articles has convinced the explorers that the Babylonians understood the art of making bronze out of an alloy of copper and antimony, at least five thousand years before Christ.

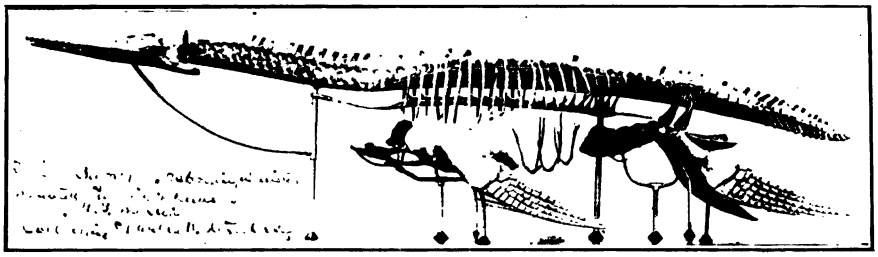
A New Fuel.

A new fuel has been introduced by the Randall Synthetic Coal Co., of Boston, Mass. It is a mixture of peat and petroleum. The peat is raised from the bog by a clam-shell digger or dredger, and conveyed to a disintegrator which separates the fine from the coarse material. It is then pressed to expel half the water and again disintegrated. Lime is added, and the whole is dried. Petroleum with bituminous pitch in solution is mixed with it in a pugmill, and briquettes are formed.

A PLESIOSAUR OF THE CRETACEOUS OCEAN.

BY CHAS. H. STERNBERG.

In a former article in Popular Science News (June, 1901), I gave an account, with illustration, of the slab of chalk through which were scattered the bones of a Plesiosaurus skeleton, discovered by myself in 1900. The reader will be interested to learn that this specimen has been beautifully mounted, as in life, by Mr. H. T. Martin, the skillful assistant of Dr. S. W. Williston. Dr. Williston has made a scientific study of the animal, and has described it as a new species, under the name of Dolichorhynchus osbornii, in honor of Prof. H. F. Osborn, of the American Museum, and U. S. Paleontologist. And it gives me great pleasure to give one of Dr. Williston's photographs of the mounted skeleton of this most complete of all the Plesiosaurs. The acquisition by the University, and the labor and study put upon it show how highly our University prizes this powerful swimming lizard of the old Kansas sea.



DOLICHORHYNCHUS OSBORNII.

In the British Museum is mounted a young animal, of a similar form. It is not as perfectly preserved as this specimen. This represents one of the smallest genera of the great group of Plesiosaurs. The entire skeleton is only 10 feet long; the skull measures 22 inches—the one here figured is an exact model of the skull as in life. This was made to replace the original bones which were crushed by the pressure of the overhanging mass, and lies in a glass case beside the restoration. All the other bones except a few unimportant ones, were found with the skull. The powerful front paddles are 26½ inches long, the hind ones 27 inches. The height at about the center of the body, is 18 inches, giving a girth of about 5 feet. There are 20 vertebræ in the neck, giving a long powerful fulcrum on which to exercise the head. The lower jaws extend back of the base of the skull, giving great leverage power to them in crushing their prey which were evidently fishes, with which the sea abounded. It also gave a wide gape to the mouth, and we can conceive of this lizard throwing them in the air and catching them as they fell into the cavernous depth below. The tail is remarkably short, and could have been covered with the hind paddles. A discovery of this kind is one of a lifetime, and it is gratifying that an American university is the possessor of it. So this most complete skeleton has an honored place at home, and did not have to seek a place of refuge from the destroying agencies of time or the vandal hand of man in foreign lands.

This specimen, as already mentioned in Popular Science News, was discovered in the chalk of Kansas, on Beaver Creek, Logan Co. In my 20 years experience as a collector in these fossil fields, I have only found two fine Plesiosaurs and neither of them can compare in completeness with this. It may not be out of place here to quote from Prof. Cope, showing how sure are men of science to get animals out of proportion when from a few isolated bones they attempt a restoration. He says on page 44, Cretaceous Vertebrata, 1875: "Far out at sea on the expanse of this ancient sea, might have been seen a huge snake-like form, which rose above the surface and stood erect, with tapering throat and arrow-shaped head, or swayed about describing a circle of 20 feet radius above the water. When plunged into the depth, naught would be visible but the foam caused by the disappearing mass of life. Should several appear together, we can easily imagine tall, flexible forms rising to the height of the masts of a fishing fleet, or like snakes twisting and knotting themselves together."

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The First Map of America.

The Brown University committee in charge of the John Carter Brown Library of Americana has recently had under consideration a proposition that the library should make an offer of $50,000 for the first map containing the name "America." The offer has not been made, nor is it likely to be made in the near future by the library authorities, and so it is extremely improbable that this priceless relic of the early history of this country will ever find a home in Providence.

The map to which this extraordinary value is attached is the property of Prince Woldenburg, of Wolfegg Castle in Wurtemberg, Germany. A short time ago an agent of the Prince approached the London agent of the Brown library with the proposition that the Providence institution should offer £10,000 for the map, implying that the price named would secure this great geographical relic. The agent communicated with his superiors, and the committee took the matter under consideration. After due thought and consultation the committee decided not to make the offer.

It was thought that the proposition of the German agent was nothing more than an attempt to secure a definite offer on which to base negotiations, by which a much higher price could be secured elsewhere. It was also thought doubtful if the German government would allow so valuable an article of historical and geographical interest to leave the country. With apparent negotiations pending for the sale of the map and its removal to the United States, the German government would probably step in and make the purchase on its own account, placing the map in the Berlin Library. The proposition appeared like an effort to use the American offer as a cat's paw for the purpose above mentioned, and the Brown Library Committee declined to be made use of in that manner.

The map is of undoubted authenticity and is considered by experts to be worth much more than the price mentioned.

In 1507, there was published at the town of St. Die, in the Vosges mountains, a small geographical treatise entitled "Cosmographiæ Introductio," in which it was suggested that the then lately discovered fourth part of the world should be called "America, because Americus [Vespucius] discovered it." A copy of this book is in the John Carter Brown Library. One of those associated in the preparation of the volume was Martin Waldseemuller, a prominent geographer and cartographer. The book purports to contain some principles of geometry and astronomy necessary to an understanding of the subject; also an account of the four voyages of Americus Vespucius. In the book is mention of a map and a globe on which were representations of the newly discovered country. It has long been contended that if this map and globe ever came to light, the newly discovered western lands represented thereon would be found to bear the name "America" as suggested in the book. This seemed a certainty when two manuscript maps by Glareanus were discovered at Munich and Bonn, both bearing the name "America," the Bonn map being dated 1510.

For the past century there has been a diligent search for the maps of Waldseemuller, but no specimens were seen or heard of, and some historians and geographers in recent years have even gone so far as to state definitely that the globe and the map were never issued at all, and that the book was published alone. About two years ago the geographical world was startled by the announcement that Waldseemuller's long-lost map of 1507, together with another of his of 1516, had been discovered by Prof. P. Joseph Fischer, in the library of Prince Woldenburg, in Wurtemberg. The map is a wood engraving and is bound in a folio volume, with several other maps of value, and is in an excellent state of preservation.

It is probable that other copies of the map, printed at the same time, were not so well protected and have passed out of existence with the ravages of time in the four centuries that have elapsed. An interesting point in relation to the name America is that it is omitted from the Waldseemuller map of 1515, the geographer evidently having learned from the narratives of voyages accessible since the preparation of his first map in 1507 that Americus Vespucius was not, as he had hitherto thought, the first discoverer of the New World.

The sum of $50,000 is a high price to pay for one map when an atlas full of maps may be bought anywhere for a very few dollars. Yet this price is not considered exorbitant and experts say that the map would easily bring from $75,000 to $90,000 if offered at auction in London. It is thought that an offer of $100,000 might secure the map to this country, and possibly some multimillionaire or historical association will yet come forward with a price sufficient to bring the map to the country where, by all the sentiment of association and tradition, it properly belongs.—Prov. Journal.

Babylonian Discoveries.

Herman Hilprecht, who has been excavating mounds in Nippur, said recently that he would devote his life to deciphering the 23,000 tablets found while excavating. He said "that the contents of the tablets will altogether change the ideas of the world as to the state of civilization and knowledge of that early people. It will be seen that they knew, 2,300 B. C., that the earth was a globe, and that their astronomers took the same view of celestial phenomena as we now take.

Nippur is, in fact, sixteen cities, one built above the other. We have by no means reached the lower of the buried cities. Much of the Temple Library has been brought here, and it is now in the museum of the university of Pennsylvania. The temple in that early period was not only the place of religious worship; it was, also, the school, the college.

Within the last four months our most important discoveries were made. The day before I embarked on my homeward voyage I had in my hand a tablet upon which were the minutest astronomical calculations as to the constellation Scorpion.

One of the most interesting tablets is mathematical. The Babylonians, in the multiplication table, for instance, went far beyond us. Our multiplication table stops at 12; 12 times 12 is the highest. The Babylonian tables went up to 60. Their children might have sung 60 times 60 in reciting the multiplication table. Indeed, for astronomical purposes, they carried the table out to 1,300; that is, the results of multiplication up to 1,300 times 1,300 were tabulated. They wanted to know at once the result of large calulations. They did not want to be retarded in their work by arithmetical problems; that was why they extended the table so far.

The Babylonian children would have been wonders in our view. Not only did they have to learn arithmetical tables carried out to four figures, but they also had to learn two languages: the Babylonian and the Samarian, one a learned, the other a colloquial language; and that in the schools of the lowest grades, and not as our children learn Latin in the high school, by the mouthful, but so thoroughly as to be able to speak and write them.—Sun.

The First Automobile.

The Chicago Chronicle says that only a small percentage of those who nowadays see automobiles speeding along the streets and boulevards, are aware that the first automobile considered in the sense a vehicle containing within itself powers of locomotion, of which there is any authentic account, was a self-moving shrine of Bacchus.

This was the invention of Heron, of Alexandria, who describes it in his work on automatic mechanism. The shrine in question was mounted upon two supporting and two driving wheels. On the axle of the driving wheels was a drum, about which was wound a rope which passed upward through the space on one side of the shrine over pulleys, and was fastened to the ring of a ponderous lead weight, which rested upon a quantity of fine dry sand.

The escape of this sand through a small hole in the middle of the floor of the compartment containing it, allowed the lead weight gradually to descend, and, by pulling up on the cord, caused the shrine to move slowly forward in a straight line.

Heron describes the method of arranging and proportioning the wheels in case it was desired that the shrine move in a circular path. He also shows how the shrine can be constructed to move in a straight line.

Officials of the Patent Office overlooked the device of Heron when they granted patents on machines, notwithstanding that previously Thomas Ewbank, Commissioner of Patents in 1850, illustrated and described Heron's invention. The mechanism of the latter is almost identical with that in the modern device, and simply serves as another proof of the saying, "There's nothing new under the sun.'

A New Discovery in Mexico.

An archæological discovery of the first importance has just been made near the city of Oaxaca in the southern part of Mexico by Leopoldo Batres, government archæologist of Mexico, who accompanied Prof. Marshall H. Saville, of the American Museum of Natural History, to that region recently.

The ruins of a great city, older than any previously discovered on the American continent, have been uncovered. The objects found in the temples and tombs thus far excavated seem to link this city with both Egypt and China.

The specimens of jade found at Monte Alban are the most beautiful in color, the most elaborately carved and the most highly polished ever found in Mexico. The workmanship upon them is exquisite. With what tools these people worked as yet remains a mystery. More significant than this was one of the pieces found. It is about as large as the palm of the hand, of a rich deep blue color, and with the face of a Chinaman, almond eyes, queue and all most delicately and perfctly carved upon it.

A small silver figure of a Chinaman found in the southern part of Mexico, is now in the Smithsonian Museum at Washington, having recently been presented to it by W. W. Byam, of Washington, who has large land interests in southern Mexico and is an enthusiastic amateur archæologist. This was pronounced by archæologists at the time of its discovery, to be the best proof thus far adduced of prehistoric communication between America and China. The jade discovered at Monte Alban is still stronger proof.—Sun.

Devil Worshippers of To-Day.

Railroad engineers have enabled the world to learn something, at least, about the devil worshippers of Asiatic Turkey, who dwell in the hills east of Mosul on the Tigris, near the ruins of Nineveh.

The Turks call them Extinguishers of Lights. They are Kurds, and recognize two forces only in the world—the good and the bad. Arguing that the good cannot do any one harm, they worship the bad in order to keep solid with it. They dare not even mention the devil by name. If they refer to him at all, they call him the "Mighty King" or the "King Peacock."

An Old Brown Cedar.

Prof. Bessey, of Nebraska University, who is very conservative as to the age of the great trees of California, writes to Science that in the Garden of the Gods, near Pike's Peak, Colo., there are many large specimens of the brown cedar, Juniperus monosperma (Engelm.) Sargent; and in a recent visit to that place it occurred to the writer that these trees must be very old. On the 13th of August he was fortunate enough to find the stump of a recently cut tree, on which it was easy to distinguish the annual growth-rings. These were counted for a section of the trunk, care being taken to select a portion in which the rings were of average thickness, and on this basis the number for the whole stump was calculated. In this way it was found that this particular tree was between 800 and 1,000 years old. In other words, this tree was a seedling some time between the years 900 and 1100 A. D.

A COLORADO AUTUMN.

BY H. A. CRAFTS.

If there is one thing that Colorado prides herself upon more than another, it is her climate, and the records would seem to show that she is quite justified in so doing. Prof. L. G. Carpenter, of the department of irrigation engineering at the Colorado State Agricultural College at Fort Collins, has a set of figures resulting from his observations, covering a period of some ten years, which show that the average annual rainfall at Fort Collins during that period was 13.58 inches, while that at New York City for the same period was 46.69 inches; that the average number of stormy days per year in Fort Collins was 54, while in New York they numbered 135, and in Columbus, Ohio, 143. The percentage of sunshine at Fort Collins was 64.9, and at Geneva, N. Y., 36.7. In fact, the constant resident in Colorado sometimes feels that he has a surfeit of sunshine and would gladly welcome the more frequent occurrence of a stormy day. But to show that the Colorado sunshine is thoroughly appreciated by Colorado's own people, it is only necessary to hear the dire complaints that are made on all sides should a storm last more than a single day.

And during all the four seasons in which Colorado enjoys these climatic blessings, autumn is the one she most dotes upon; and in truth it is a prolonged succession of halcyon days. The Indian summer of the east is something that poets sing about and sages acknowledge to be a season of unalloyed felicity. But take the eastern Indian summer and prolong it from three weeks to three months and you have the average Colorado autumn. Mind you, these remarks refer to the climate of the plains and lower foot-hills and not to the higher altitudes of the Rocky Mountains, for in those upper regions the storm king holds a more absolute sway, and snow storms are the order of the day for about nine months out of twelve. And let it not be understood that even the lower altitudes are not subject now and then to a seemingly unseasonable fall of snow.

In 1895, snow fell in eastern Colorado to the depth of a foot on the 21st of September, and the snow being moist, clung to the trees in great masses, causing much damage to fruit and shade trees. But no sooner had the storm ceased than the sun shone forth warmly, dissipating in a few hours every vestige of snow, leaving the whole earth refreshed with coolness and moisture. September 5th of 1898 saw another fall of snow in the same region, only it was not so heavy as that of 1895.

But from those prolonged autumnal storms, Colorado is almost entirely free, and it is seldom that there is really any very severe weather until about Christmas time, when there is usually a taste of winter. It is no uncommon thing to have three or four weeks together, without a drop of rain or a flake of snow, the sun shining warmly each day, save when its rays are tempered by a veil of over-hanging haze. An occasional day of rain or snow only tends to lay the dust in the city streets and along the country roads, and freshen up the face of Nature generally.

While Colorado is destitute of those wide-spreading forests known to the eastern states, her autumnal landscape is not devoid of natural beauty. The grass upon the great uncultivated plains turns to a soft brown, and, when viewed through the golden medium, sun and sheen, presents to the eye a spectacle of wide but mild splendor. The prairies stretch away in rich undulations until they merge into the hazy sky in the distance. Among the cultivated lands the views are of surpassing beauty. The harvest fields are yellow and teem with the gathered products of the soil. The hay stands in immense stacks in the field corners, while such of the grain as has not also been put in stack, stands in shocks throughout the fields, awaiting to be gathered. There is no fear of the harvest being harmed by protracted rainfall, and much of the grain is threshed from the shock. On every hand can be seen the smoke and dust clouds from the steam threshers, which are rapidly separating the kernels (from the straw) to be placed in sacks and stored in the house granary, or hauled to the city elevator, there to be converted into flour. The orchards are laden with fruit which bear the boughs to the very ground, and the vineyards are purple with ripened grapes.

Along the hedge rows and highways the foliage of the cottonwoods has turned a brilliant yellow, and the leaves are falling in the light breeze that blows coolly from the east, while swarms of chattering blackbirds hold forth loudly in the denuded branches. The kine have been turned abroad in the shorn fields, where they graze contentedly, their sleek sides glistening in the noon-day sun. Along the country roads are loads of grain heaped upon huge farm wagons wending their way to market. There are also loads of hay, cabbage, potatoes and a great variety of other produce that has been derived from a generous soil and genial climate. There are farmers and farmers' wives, accompanied by numerous red-cheeked offsprings, comfortably pursuing their way townward to invest the product of their toil in supplies for the household. In town the merchants are all busy with fall trade, bent upon securing a fair share of the general prosperity that abounds.

In Colorado the autumn is the festival season. There is the great festival of the "Mountain and Plain," held in the capital city in the early days of October, and attended by thousands of visitors from all over the state and from neighboring states and territories. Then in various parts of the state there are held smaller festivsls, embracing some feature of each respective locality. One town has its grape day, another its apple day, a third its peach day, while elsewhere there are potato bakes, corn roasts, watermelon feasts, etc., to which are conveyed large numbers of excursionists, to whom the railroads have made special rates of transportation. These harvest festivals have largely taken the place of the old-fashioned county fair, which in Colorado seems destined soon to become obsolete. In the smaller rural districts there are country dances, corn huskings, apple bees, straw rides, and a variety of other amusements of an enjoyable and innocent nature.

And in these soft autumn days, picnicing in the mountains is a pastime embodying a world of rustic pleasure. The grass on the hill sides has turned a buff brown; the foliage of the wild cherry trees and quaking asps in the glens have put on gay colors, and there are sunny, sheltered nooks that afford fine grounds for lunching, while commanding grand views of the surrounding hills The mountain roads are hard and smooth, so that driving or wheeling may be indulged in to the heart's content. There are still camping and hunting parties going to and from the hills, many preferring the autumn to the summer for camping, which can then be legally joined to hunting. On the plains the sportsmen are busy with their fowling pieces shooting ducks on the lakes and in the sloughs, and shooting jack rabbits on the prairies.

And when all these pleasures can be pursued day after day without the interference of storm or tempest, mud or mist, rain or snow, it is no wonder that Colorado is given to self-congratulations upon the score of climate.

Again, it is perhaps needless to add that Colorado is a mecca for invalids.

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Express Trains at all Stations.

Mr. J. B. Brown, of Belfast, advocates the seeming paradox of express trains stopping at all stations. He brought to the meeting of the British Association a large working model of a railway with an electrical train upon it, to show exactly how it may be accomplished. The idea is simple. His train is composed of several corridor carriages, and as it passes through each station it drops off behind one carriage containing all the passengers who want to alight there, and picks up in front another one with passengers from that station—all this while traveling at full speed. The carriage to be attached, however, has to start in advance and get well under way by the time the train catches it, and is coupled up by a patent automatic arrangement. The scheme is only possible when each carriage has its own motors on the multiple unit system.

VIEW OF AVALON, CATALINA ISLAND, CAL.

CATALINA ISLAND SLOWLY SINKING

BY J. MAYNE BALTIMORE.

Prof. William E. Ritter, who holds the Chair of Zoology in the University of California, claims to have recently made a most important scientific discovery in regard to Santa Catalina Island. In his opinion, and also in the opinion of other scientists of the university, that island is slowly sinking into the Pacific Ocean. The rate is not rapid, but it is considered certain that unless some great geological change takes place, Santa Catalina Island will eventually disappear from the face of the sea.

This astonishing discovery Prof. Ritter claims to have made while dredging for marine animals in the waters about the island. About three quarters of a mile off Long Point, on the north side of Catalina, Prof. Ritter's dredges brought up large numbers of cobblestones varying in size from a sparrow's egg to a man's head. Each one was covered with a thick coating of encrusting worm tubes, bryozoa and other marine growths of great age, which showed that they had remained undisturbed for a long period.

They were exactly the form of stones found on all rocky beaches, such as those of Catalina, and it was evident that they belonged to an ancient beach on the island, long submerged under the rising waves. The water at that point was 45 fathoms deep.

Prof. Ritter concludes that the shore line of Santa Catalina Island at no remote date was at this point three-quarters of a mile to a mile farther out to sea than at present. From the depth of the water now lying over the ancient beach, the island has sunk 270 feet since that was the margin between the waves and the land. Santa Catalina was then very much larger than it is now, and its mountains just so much higher. The isthmus could scarcely have been called by that name then; and the locality where the little town of Avalon now stands, and where the steamers touch, was doubtless well inland.

The most curious fact in connection with this phenomenon was the further discovery by the university professors that San Clemente Island, just south of Santa Catalina, and San Pedro hill on the edge of the opposite mainland, are not sinking, but, instead, are rising higher and higher above the face of the sea. Santa Catalina was an island before San Clemente or San Pedro hill emerged from the ocean. Both of them, it is believed, appeared in very recent geological time, and neither has yet stopped rising. On San Pedro hill, which is now 1,475 feet high, as many as ten separate beaches may be traced at different heights from the base to the top. San Clemente island is now 1,964 feet high.

In Prof. Ritter's scientific opinion, it is impossible to determine just how fast Santa Catalina is sinking and San Clemente rising. The occupation of the former island by white men has been so recent that no change has probably been noticed, and the scientific discovery of the fact has given no time for an attempt to determine the rate.

It is an interesting geological question whether or not Catalina has ever been connected with the mainland. Several ordinary mainland animals, notably foxes and the common ground squirrel, which could hardly have crossed the waters by themselves, are abundant on the island. On the other hand, there are several plants and trees on Santa Catalina which are unknown on the mainland.

Seeking the Life Principle.

Biologists never give up hunting among the material elements for the divine spark from which all life is supposed to have sprung. Though in a number of cases some things having a close resemblance to primitive forms of life have been produced by chemical action, none of these have been accepted as going beyond the dividing line.

At a recent scientific congress in Italy, Dr. Leduc told how by sprinkling a few drops of ferro-cyanide of potassium on a thin layer of gelatin he could cause to "start into life a collection of cells having a regular polyhedric form and containing each a nucleus, a sac of protoplasm and a membrane exactly like the cell of plant or animal." The doctor does not assert, however, that these cells had the power of growth, movement or reproduction. Their resemblance to natural life cells was doubtless purely superficial.

PORTO RICAN ROCK RICHES.

BY O. W. BARRETT.

Since Dr. Day's discovery of platinum near Corozal, there has been an increasing interest in the mineral resources of the island; and we are now discovering that the gem of the Antilles is not composed entirely of clay and limestone.

Gold has been mined here for many years. In 1538, the city and the royal officials in Porto Rico, informed the King of Spain that: "Gold is decreasing; lead layers have been discovered which yield some silver." According to the old documents, the total output of gold from 1509 to 1536 was $3,495,800. The sand of nearly every river bed in the northeast part of the island gives "color." Even with the primitive "slide-box" methods employed at Corozal, the daily production of gold is considerable.

Silver has been found at several localities in the northwest part of the island and at Guayma.

Lead occurs as a sulphuret at Arroyo, Guayama, and other places.

Pyrolusite has been discovered in sufficient quantities to warrant the taking up of concessions in the Corozal district.

Nickel occurs at Naguabo, and traces of native bismuth have been reported from Ponce. Small quantities of tin are occasionally seen in the gold washings at Guayama.

Quicksilver exists in the Corozal formation and graphite has been reported at Adjuntas.

Copper has been mined at Jayuya and Rio Blanco, and various compounds of it occur in many localities.

Jet occurs at Maricao, and traces of amber at La Moca. Bituminous lignite has been found at Cabo Rojo, Caguana, and Utuado.

Phosphate rock of fair grade occurs on several of the outlying islands and at Manatí, Ponce, Cabo Rojo, Lajas, San German, and other points on the mainland.

Stellar Comparisons.

When we lift our eyes to the starry vault upon a clear night we are apt to think the stars numberless and the heavens crowded. Yet the total number visible at any one place at one time is only about 3,000, and in the whole heavens about double that number. But the telescope and the photographic plate have made us aware that for every one visible to the eye, there are at least 16,000 existing in the skies, and when we read of a total of at least 100,000,000 we think space must be crowded with orbs like the sands on the seashore. The beautiful photographs reproduced in popular books of recent years confirm us in the impression that there is hardly elbow room in the sky. Yet what are the facts?

Every one of these 100 millions of stars is a sun, on the average as brilliant in surface as our sun, so that if they collectively filled as much apparent area as the sun, we should have an endless day. But they do not give even 100th of full-moon light, and the full moon gives only $\frac{1}{618000}$ part of the light of the sun, so that the whole of the stars only give us $\frac{1}{62000000}$ of sunlight, which means that if the whole of the stars could be collected into one disc they would only cover $\frac{1}{62000000}$ of the area of the sun, and would not present a definable shape even in large telescopes. This consideration alone shows how little crowded in reality the stars are.

But the nearest star is at least 275,000 times as distant as the sun, so that if we represent the sun by a pea, the nearest star will be another pea 102 miles away, and the next nearest much further from either. There are differences of distance in the depths of space; but we have no evidence that the average distance is less, and certainly they are not less for an incomprehensibly vast space surrounding the solar system, so that the crowded state of the sky may be symbolized by representing it as about as crowded as three flies would be if they had the whole island of Great Britain to themselves, or as two men would be if there were no other living creature on the surface of the earth.—Eng. Mechanic.

The Swiftest Boat.

The most extraordinary achievement in the domain of fast yacht or torpedo boat construction, has lately been reported as the outcome of Mr. Chas. D. Mosher's work in designing the high-speed steam yacht, Arrow, for Mr. Chas. R. Flint, of New York. On the 7th of September this craft made a speed of above 45 miles an hour on the Hudson River, making the mile in less than one minute and twenty seconds. The measured mile was established by the Coast Survey, which sent its steamer Bache to fix its location some time since. This performance exceeds by three miles, nearly, that of the British torpedo-boat destroyer Viper, with engines of the Parsons type of steam-turbine. The latter made 42.25 miles an hour, a mile in one minute and twenty-five seconds. The Arrow is but 130 feet over all, 12 feet 6 inches beam, displacing 66 tons, on a draft of 4 feet 7 inches. The water-tube boilers contain 5,540 square feet of heating surface and the quadruple-expansion engines are capale of producing 4,000 horse-power. Maximum steam pressure is reported to be 400 pounds at the boilers and 390 at the engines.

Power of Birds.

What tremendous power an eagle exerts when carrying away a lamb that weighs, say, 60 pounds or over! If you take the weight of the bird together, 76 pounds, then it appears to me that an eagle can develop more than 2 horse-power, and must put a strain of over 1,100 pounds on the muscles of the wings, which leads one to think that "birds are stronger than mathematics."

FOREIGN NOTES.

Condensed from recent French sources, especially the Revue Scientifique, are the following items:

The Poison of Moulds.—M. Di Pietro, of the hygienic institute of Rome, by a series of experiments on animals and himself, finds that the poison of the green mould, Pencillium glancum, has its noxious quality in the green spores, not in its filaments, the mycelium; and that this poison, developed about the third day, persists after boiling many hours; also that is soluble in alcohol and petroleum ether, retaining its toxicity. Its effects are vomiting, diarrhœa, prostration, etc.

Sheep Milk.—MM. Trillat and Forestier have studied this and find that its weight in extracts exceeds the best cow's milk in the proportion of 200 grams per litre to 160 or 165; also it surpassed in fat, casein and mineral matter.

Changeable Colors of Integument.—These are such as the prismatic colors of shells, scales of fish, wings of insects, feathers of birds. The variability has been explained variously, some attributing it to the dispersion of light, others to thin plates. H. Mandoul, by careful investigation, is convinced that it is due to interference of light in the thin plates that compose the integuments.

Treatment of Vine Insects.—In Europe the small Pyralids (apparently numerous larvæ of the moth) are enemies of grape vines. Messrs. Vermorel and Gastine have a new method of destroying these by steam or hot vapor (vapeur d'eau), holding the stem under a bell-glass. It kills them at once.

Freaks of Lightning.—In Hainaut a man's body was cut in two. In eastern Flanders, of three neighboring poplars, the first was split, the second had its shivered trunk carried away a score of metres, the third stript of its branches. Still another in the vicinity had its bark thrown 40 metres. At Merendré, a stroke of lightning, breaking windows, struck a heap of potatoes (more than 1,000 kilos), split and blackened them, so that in two days they became putrid.

Plague Propagated by Bats.—During the recent epidemic in Naples, a house became infected, although separated from the city by a wall, and with a separate drainage. M. Gosio inoculated some bats, which soon died. He attributes the infesting of the house to the parasites that are found on bats, these rather than the bats' hair conveying the germs.

Photographing the Interior of the Body.—M. Eykman, of Amsterdam, has published a method of X-ray photography by which the movements of the pharynx and larynx are shown. To get a distinct photograph the movements had to be repeated 120 to 130 times.

Photography

SPOTTING NEGATIVES AND PRINTS.

BY EDWARD W. NEWCOMB.

There is nothing which tends to spoil an otherwise good picture more than a spotted print from an unspotted negative, and if all would realize this, a very common blemish could easily be done away with, for, though tedious, spotting is by no means difficult. Perhaps from defective emulsion on the plate, more probably from bubbles on it during development, transparent spots are of frequent occurrence on the finished negative or it may get scratched in handling, and of course, those spots or scratches show in the print, unless filled in.

They may be just daubed over with red opaque (a very poor medium by the way, though commonly sold for that purpose), or they may be properly filled so that no sign of the patching up will show on the print. It is far preferable to take time enough on properly spotting—i. e. filling in holes—the negative so that a comparatively clean print may be taken from it ever afterward, than to daub on a medium in a careless way, which fills the holes but calls for an equal amount of touching upon the white spots on each and every print taken off, thus increasing the work of producing a perfect print a hundred per cent. Once properly spotted, a clean print is assured, unless the paper may have an occasional blemish, so it decidedly pays to spend time in working over a negative before placing it in the printing room. We may not only spot, but remove defects as well, heighten effects, subdue others, and even if we do not understand retouching, remove deep shadows, freckles, etc., in portraits before printing.

For this work there will be required three fine sable brushes, several pencils from a very hard to quite soft grade, a retouching frame, a bottle of retouching fluid, a little gelatine and a stick of India ink, as well as a few moist water colors, such as brown, sepia, gamboge, Prussian blue and scarlet lake. The retouching frame may be easily constructed after a glance at the cut of one in a dealer's catalogue, if one is handy with saw and nails. It is simply a convenient easel for the negative while working on it; at a pinch a printing frame with legs and a white card behind to reflect light would answer. It is well to grind up some India ink on a porcelain slab, using gelatine solution instead of water, and to have dabs of the other paint on the slab also, and now to spot the negative we have in the frame on a table before a window. Many tack a black cloth upon the frame and cover the head while working, as greater accuracy in matching can thereby be obtained.

We will first fill all the largest holes and scratches with India ink, using a brush of small size, well pointed by drawing through the lips and never filling a hole in one dab, but rather by a series of slight touches with not too much India ink. By persistently touching the spots, a little touch at a time, we can observe how near we come to matching the opacity of the surrounding parts, and thus, patiently filling the hole and noting the result, we can make it impossible to detect the patch. The very small pinholes are to be touched with the tip of our finest brush, using a reading glass if necessary, always remembering never to do in one touch what could be done in ten, if fine work is desired. If the holes go clear through the emulsion to the glass, they may be first filled with thick gelatine solution, and when dry touched with retouching fluid and filled with the pencil, using fine crossed strokes like a continuous figure 8, or they may be filled with a filler made from scrapings of a worthless negative melted up in a water bath. This latter method is a favorite one with many, as the filler, carefully laid on, is pretty apt to match nicely.

For landscape work, any of the methods described answer the purpose, and with practice and patience good work may readily be accomplished. For portrait negatives, I think it is best to use lead entirely, except for defects in positions other than the face. Apply a single drop of retouching fluid to the face, and with the ball of the finger, rub it around till the entire part to be worked over is covered, then when tacky, fill in the shadows and freckles with delicate touches of a very finely pointed 4 to 6 H Faber lead pencil. If there be clear holes, it is better to fill them first with the gelatine solution before mentioned.

Freckles must be touched until they exactly match the rest of the face, and it is well, before quite through, to take a proof or two to make sure that it is not being overdone. Shadows, if deep, should be filled somewhat, but not entirely; deep wrinkles are to be likewise toned down with crossed strokes (the figure 8 is an easy stroke to use), but never entirely filled, for with their elimination would also disappear all likeness. In case the face is in deep shadow or, for that matter, in case of deep shadows on any negative, it is best to overcome the trouble by putting on more or less opaque color on the back. For medium heightening use a dab of Prussian blue and pat it with damp fingers till smoothly spread over the required area. By changing the negative about, the lines left by the finger may be crossed and recrossed until an even patch of color is secured. More contrast may be had by the use of gamboge, and still more by the use of crimson lake.

So much for filling in defects; should occasion arise when it would improve the negative to remove an object that prints white or perhaps only tone it down, it must be etched away, and if necessary, spotted a trifle afterwards. Sometimes we forget to look our sitter over carefully, and find a handkerchief protruding from the coat pocket to the very great disadvantage of our result as a whole, or mayhap a rock in our landscape takes very white and presents a notably conspicuous appearance in our picture. These things must be toned down or entirely eliminated by patiently scratching with little chisels which may be conveniently made by grinding three or four needles of different sizes to an awl point and setting in slender handles about the size of a pencil. With the etching tools we also deepen shadows when necessary.

To improve many prints, it is necessary to supply a sense of distance that is lacking, perhaps through stopping the lens down too much, at any rate, the values are not marked enough and the picture is flat. We could touch up the print itself with paint, but this is not economical.

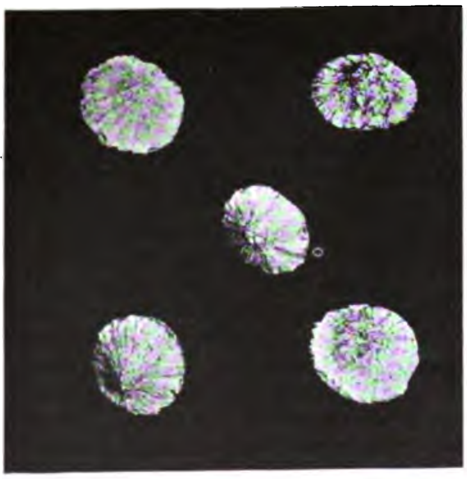
Mineralogy

[Edited by A. C. Bates].

Herrengrundite is a mineral named after the town in Hungary in which it is found. Good specimens of this mineral are seen in but few collections. It is a beautiful mineral and is related to langite and brochantite. It occurs with malachite and calcite. In color it is emerald green, or sometimes bluish-green; pearly, and rather brittle. The crystals are thin, six-sided, tabular, and occur usually in spherical groups The low prices once asked for this mineral would indicate that it is not a rare species.

Rubies. Since the coronation ceremonies the newspapers have printed many articles respecting the ruby, but none has been correct in the details. The longest and ablest article says: "A blue ruby is a sapphire, and a red sapphire is a ruby," which is in a sense true, but not clear. Rubies and sapphires are a variety of the species corundum, and of which there are other varieties distinguished by their color. A species is determined by its composition; a variety by its impurities, accidental or otherwise, which often affects color and form. Keeping this fact in mind will help one's understanding.

Chalcedony.—A couple of years ago there were found in Japan a lot of stellate concretions of chalcedony unlike any heretofore found, several specimens of which are shown in the illustration. They are opaque, yellowish white in color, and at first glance look like fossils Chalcedony is cryptocrystalline, assuming chiefly botryoidal or mamimillary forms in a wide range of color.



CHALCEDONY CONCRETIONS, JAPAN.

Tempered Copper.—An antiquarian recently said he doubted the existence of any tempered copper implements. It is reported that during the present summer, a large number of tempered copper tools and utensils were dug up from the sand near the entry to the Portage Lake ship canal, Michigan. The collection so secured contains a number of tempered cutting tools, and one peculiar article, use unknown, which has a stiff spring. The age of these articles may be a few hundred or several thousand years, but the copper was so treated that the peculiar properties of edge and resilliency have been imparted permanently.

Iron.—The inventory of Iron Mountain, Utah, shows 150,000,000 tons iron ore exposed, the deposits on Lindsay Hill alone revealing as much as 40,000,000 tons of hematite, that in phosphorous is clearly within the Bessemer limits. In addition to this, the inventory shows enormous deposits of magnetic iron which registers 63 per cent. in the metal, with .015 phosphorus which makes it most desirable for open hearth steel. One of the experts estimates that the deposit carries a billion tons of ore.

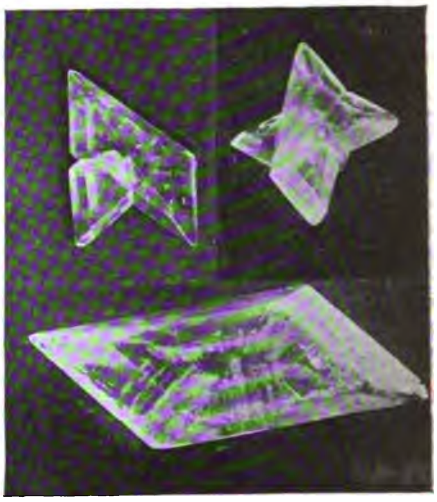
Borax.—The production of borax in the United States is derived mainly from the Colemanite deposits of California. The deposits of borax in the marshes of Nevada and Oregon furnish but a small amount. The total output in 1901 of crude borax was 17,887 short tons.

Borax has been obtained since early times from the Salt Lakes of Tibet, and until the discoveries in Nevada and California this was the most important source. It was brought to Europe in the crude state under the name of tincal and there purified. The Tibet lakes are at an elevation of 15,000 feet, and here the borax is obtained in successive crops by the action of moisture (rain or snow) and subsequent evaporation.

At Borax Lake, California, perfect crystals are found (buried in the lake mud) up to 7 inches long and weighing a pound. These crystals are transparent, but turn opaque on exposure and are saved from loss by a coating of varnish. Ulexite is also an ore of borax, and occurs in rounded masses loose in texture, consisting of fine fibers which are acicular crystals, and is found in the marshes of Nevada.

Colemanite is now the chief ore of borax and occurs abundantly in San Bernardino Co., Calif. The crystals occur beautifully clear lining geodes in the massive mineral, sometimes associated with quartz, and good specimens have been prized by collectors since their first discovery in 1882. At that time good specimens fetched enormous prices because of the difficulty of travelling in Death Valley. Now a good specimen may be had at a comparatively low price. Death Valley lies 50 miles east of the Sierra Nevada and only a few miles west of the Nevada state line. This valley, about 480 feet below sea-level, has mountains towering on either side nearly to the region of perpetual snow. Death Valley is regarded as the hottest place in the United States. At the ranch maintained near the mouth of Furnace Creek by the Pacific Coast Borax Company, the summer temperature is reported to reach 137° in the shade; but by means of a double roof and running water, habitation is rendered possible even in this intense heat.

Gypsum is one of the oldest minerals of economic history. It is a hydrous calcium sulphate, sulphur trioxide 46.6, lime 32 5, water 20.9. Gypsum often forms extensive beds in connection with various stratified rocks and with clays. It is also a product of volcanoes and is produced by the decomposition of pyrite when lime is present. It is often deposited on the evaporation of sea water and brines, and crystals may be seen to form on evaporating a drop of sea water in the field of a microscope.



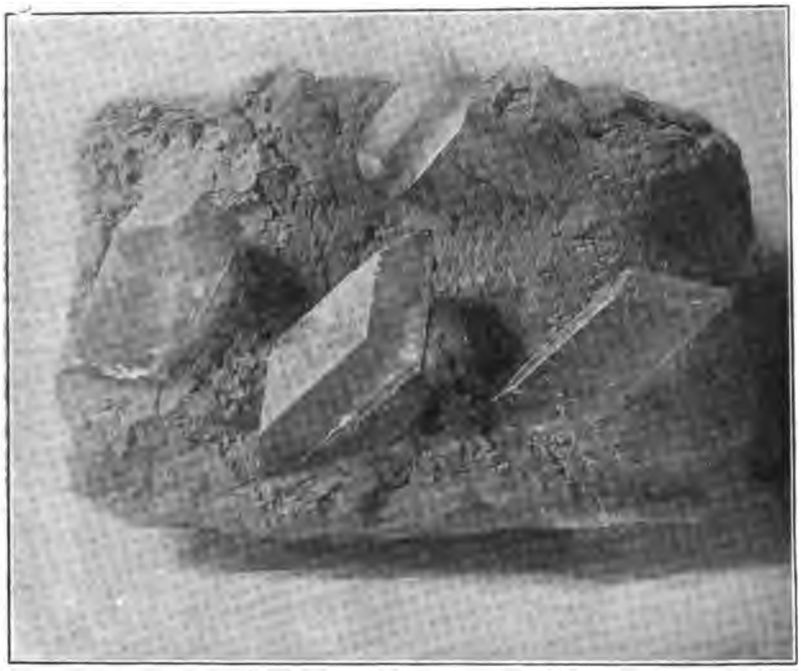
SELENITE CRYSTALS, ELSWORTH, OHIO.

Gypsum in color is usually white; sometimes gray, flesh-red, yellow, blue; impure varieties red, brown or black; and it is transparent to opaque.

The crystallized variety is selenite, which occurs in distinct crystals or in broad folia which sometimes measure a yard across and are transparent throughout. It is usually flexible and yields a fibrous fracture. Crystals a yard long are found in Sicily. In 1892 a small cave was discovered in Wayne Co., Utah, standing out in the desert sand, which was made up of gigantic crystals of selenite, many of which were taken out with perfect terminations and distributed to the museums of the world. At Elsworth, O., small perfect, simple and twin crystals were found abundantly in the clay beds. Matrix specimens are made by cutting away the clay from a mass containing crystals so as to expose them.

Satin spar is a fine fibrous variety which has the pearly opalescence of the moonstone, and is much used in cheap jewelry. The best is found in England.

Of the selenite crystals perhaps the prettiest and most pleasing are those called fishtail twins, so named because of their shape, and the cruciform penetration "twins" (which are not true twins). These, together with a "phantom" crystal, are



SELENITE CRYSTALS IN CLAY MATRIX, ELSWORTH, OHIO.

shown in the illustrations and all are found at Elsworth, O. In the Mammoth Cave, Kentucky, the gypsum often takes the form of rosettes, flowers, vines and shrubbery, and these are fantastically beautiful when viewed disposed about the cave.

Alabaster is a fine grained variety, either white or delicately shaded, and occurs in fine quality at Castelino, Italy, whence it is taken to Florence for the manufacture of vases, figures, etc.

Burnt gypsum is called plaster-of-paris, because the Montmartre Gypsum Quarries, near Paris, are, and have long been, famous for affording it.

Coal Mining Accidents.—The reports of the U. S. Geological Survey for 1901 shows that in eighteen states the number of deaths in coal mining due to accidents was 1,467, and the total number of men injured was 3,643. The total number of men employed in the coal mines of the U. S. in 1901 was 485,544, who made an average of 216 working days.

Natural Gas.—The consumption of natural gas has continued to increase, although the pressure, except in the new fields of West Virginia, has continued to decline, necessitating the expense of compression in order to market an increased production from the declining fields, which expense must continue to increase as the pressure declines and the distance to the source of supply increases.

The value of natural gas consumed in the United States in 1901 was $27,067,500, which, at 15 cents per 1,000 cubic feet, is equivalent to 180,450,000,000 cubic feet. If it were possible to store this gas in a cube, the density throughout being equal, its sides would be 5,530 feet in length, or 250 feet greater than the sides of a cubic mile. If 20,000 cubic feet of natural gas be taken as equal to 1 ton of coal, 8,458,600 tons of coal, valued at $3.20 per ton, would be required to yield the sum of money for which the natural gas sold.

As a source of power natural gas stands at the head of the list for economy among the fuels, both as to expense of installation and expense of operation.

It has been supplying the power for a very large number of factories and operations in the gas belt, and lately it has been extensively applied in creating the power by which the natural gas itself is compressed from a low to a high pressure when the original pressure has failed and the pipes are insufficient to deliver the necessary quantity of gas at the well pressure. A number of these compressors work up very close to 1,000 horse power, with an economy that enables 8 to 10 cubic feet of natural gas to develop a horse power for an hour, a saving of from 40 to 50 per cent. over high-duty steam engines.

It is estimated that fully 1,000,000 domestic fires are supplied by natural gas, and that 4,000,000 people are furnished with this ideal fuel and light.

Companies or individuals to the number of 1,545 report the use of natural gas in manufacturing establishments of various kinds, numbering in all 5,742, including 102 iron and steel works and 219 glass works.

Assessment Work.—The amount of work done on a mining claim to comply with the law governing assessments varies according to location. In Colorado a shaft ten feet deep or an open cut with a ten-foot face is the usual rule. It is, however, apparent that such a hole will cost much more in some localities than in others. Land office and court decisions have uniformly declined to compute the time required to reach the claim and return to the home of the claimant, as the opportunities for evading the work would thereby be greatly increased. The essence of the law is the actual expenditure of $100 annually in the performance of the work. The time spent in labor and the cost of necessary supplies while thus engaged are computed, the labor being reckoned upon the price fixed by the miners' courts of the district. Miners' law is still recognized by the courts in matters of this kind.

Study of Specimens.—A good many collectors of minerals are not fully cognizant of all the beauties of some of their specimens. The truth of the statement may be tested by asking a collector if he has examined such and such minerals under a magnifying glass. He may have done so, but it will be true of only a few such. Take the mineral herrengrundite, described on preceding page: its beauties are not, even in the largest specimens, revealed to the naked eye. The splendid grouping of the thin crystals and their sheeny lustre are brought out fully under the glass. And this is true of many minerals, especially those of a velvety texture.

A glass need not be of high magnifying power to show these beauties; rather, a glass that will show a large field is the better one for the purpose.

The minerals of Manhattan Island have always had a particular interest to local collectors. A list of the minerals occurring on the island, as made by the late B. B. Chamberlain, shows 76 species and 111 varieties. The collection owned by the New York Mineralogical Club is deposited with and is on exhibition at the American Museum of Natural History. This includes one of the largest dodecahedral garnets ever found anywhere, and a glossy black tourmaline of extraordinary size and perfection.

CAVE OF SELENITE CRYSTALS,
WAYNE CO., UTAH.

Hall's Journal of Health

FOUNDED BY DR. W. W. HALL 1854

HAVANA HARBOR AND YELLOW FEVER.

BY JOANNA NICHOLLS KYLE.

During the past year the theory was advanced by Surgeon-General Sternberg, U. S. Army, that yellow fever was due to the bite of poisonous mosquitoes, and the plea was instantly made by the newspapers for discontinuing the "cruel" exactions of our Quarantine laws. If this theory be correct, why has not the fever raged each year in our Southern States with equal violence, since no international code imposes neutrality upon the little winged pest-bearers whose filibustering expeditions to our shores have continued regardless of peace or war? As a matter of fact, the local conditions existing in the island of Cuba render it "a perpetual menace" to the health of the United States; yet for several years prior to our war with Spain, yellow fever had been successfully excluded from our country by the rigid enforcement of quarantine regulations.

More astonishing still is the declaration upon high medical authority that yellow fever is not Nature's punishment for the filth and indolence of a people, when a glance at the facts collected by the U. S. Marine Hospital reveal beyond dispute that a greater blessing than the independence for which Cuba has striven would be the sanitation of her ports. Havana, Matanzas, and the thirteen other harbors of entry to the beautiful island have long seen their beauty blighted, and their attractiveness turned to repulsion, by the continuous presence of the most fatal form of the terrible epidemic.

Whether Asiatic in its origin, as claimed by some, or resulting from the horrors of the slave-ships, which carried miserable Africans to the West Indies under inexpressible conditions of suffering, disease and death, yellow fever has existed in Havana since 1761, growing with its growth and favored less by climatic influences than by the almost total disregard of sanitary laws. So foul is the mud of Havana harbor, into which the "Maine" is settling deeper and deeper—a grave as infamous as her destruction—that anchors and cables drawn out of it are required to be rigidly disinfected by quarantine officials. And yet we are assured on the highest historic authority that prior to the introduction of the *vomito negro* from Vera Cruz in the summer of 1761, "Havana, although situated on the northern boundary of the Torrid Zone, was justly considered one of the most healthy localities on the island."

It is true that excessive moisture and excessive temperature are most favorable to the development of yellow fever, and that the rainfall in Havana is enormous—from 4 to 8 feet a year, and the average temperature is 77 degrees, yet these are not the prime factors in rendering Havana the habitat of one of the most virulent and dangerous diseases that afflicts mankind. Comparison of statistics of cities shows that three-fourths of the people of Havana live in the most densely populated localities of the world; about 20,000 of them, or one-tenth of the whole, upon land "reclaimed" from the sea by dumping garbage and street refuse, much of it having been formerly a vast effervescing mangrove swamp. The highest point within or adjacent to the city is 200 feet above sea-level, and not more than one-fourth of the citizens occupy homes at an altitude of 50 feet. Some 20,000 live on land less than 7 feet above high tide, and 35,000 on sites ranging from 7 to 13 feet. Many houses have the ground floor inundated by every heavy rain or by a high tide with a north wind, and the moisture mark is seen even in houses of considerable elevation.

In the northern and modern part of the city—lying towards the sea-coast rather than the harbor—natural drainage is good, the rock which underlies the thin layer of red, yellow and black earth (often not more than 1 or 2 feet thick) being permeable, so that liquids emptied upon it quickly disappear. But in the southern and larger section of the city, the rock is of Cretaceous formation and much less permeable, so that sinks and other excavations fill rapidly to overflowing. There are few sewers, and the greater part of the wash of the city empties through the street gutters into the harbor or sea. What sewers there are have been built without reference to a general plan, are badly made, of pervious material, so uneven in their course and so leaky that the city, it has been declared, would be better off without them. They are seldom cleaned and usually obstructed, exhaling offensive odors. The new system of water works, completed in 1892, without corresponding sewerage, has but increased the danger, many houses and the city generally being damper than before.

The harbor of Havana is denounced by the U. S. Marine Hospital Marine Service as "a cesspool which for years has received the drainage of the city, and is virtually a *cul-de-sac*, with no means of its being scoured by the tides or fresh-water streams." Of its actual available area of 2,005 acres (taking the hard beach as the limits) the part covered by water is only 1,482 acres, and more than one-fourth of what should be harbor (543 acres) is made land, for the most part a swamp. The circumference of the harbor space covered by water more than 26 feet deep, is very little more than 6 miles, and of the true shore, less than 14 miles in extent, more than a third is inaccessible marsh. A great part of the beach is surrounded by a zone of marshes, swamps, lagoons, pools and shallows, full of decomposing organic matter, in a mixture of insalubrious fresh and salt water, the miasma from which encounters not even a fringe of trees on its passage toward the afflicted city.

And the wharves! These are the foci of infection, being not only a continuation of the city, but being in even much worse sanitary condition, for not only the sewers debouch beneath them, so that the supporting timbers entrap filth of every description, but the two abbatoirs of the city, where from 200 to 300 head of cattle and as many or more sheep, hogs, etc., are killed and dressed every day, discharge all the blood, washings, liquid filth, the refuse from the rendering of tallow, grease, etc., into the fresh-water stream which empties on the city side into one horn of the head of the harbor.

Small wonder that Tallapiedra wharf and its continuation, the San José, should bear the title of "Dead Man's Hole," no vessel having a non-immune crew having ever been known to tie to it without an outbreak of contagion, for here is the mouth of the sewer, also, from the Military Hospital, where the yellow fever patients of the army are treated. It is the most dangerous wharf of all, and is the one to which many American and British vessels go to discharge lumber. To avoid tying up to it captains of American vessels have voluntarily remitted freight dues to the amount of $200 or $300 each for the privilege of discharging cargoes out in the open bay. The infection, it may be observed, is more common with wooden vessels. Indeed, anchorage in the bay, with little permission to the crew to go ashore is the only condition of safety, and is adopted by the large number of iron vessels entering the port.

The tide in the latitude of Havana is sluggish, and has not force enough to sweep out to sea the impurities above described, and dredging is objectionable in that it exposes to the germinating influences of heat and light the immense deposit of decomposing animal matter. With these conditions is it little wonder that Havana lost in the twenty five years from 1853 to 1879, nearly 56,000 persons by death from yellow fever, and that over 4,250 deaths have took place in the decade from 1884 to 1894. It is well known that strict quarantine regulations are enforced against vessels from Havana to ports in the United States between Norfolk, Va., and Brownsville, Tex., and no persons not absolutely immune to yellow fever are allowed to come to Florida from Cuba during the period from May to November of any year.

From the beginning of the century to 1894, however, there were but seven years in which yellow fever did not visit the United States. The source of the infection could be traced in but 41 of these visitations; in twelve instances it was attributed to the West Indies in general, but in 23 to Havana alone. In the more limited period from 1862 to 1894, 19 out of the 26 visitations of the same scourge to our shores were referred positively to that city, especially the last great epidemic of 1878, which invaded 132 of our towns, and cost the lives of nearly 16,000 of our citizens, involving also a pecuniary loss of $100,000,000 in gold.

Various engineering schemes have been suggested as possible remedies for the existing evils, probably the most obvious being to build solid stone wharves all along the front of the city, even covering the San Juan and Tallapiedra wharves. Such a project would be extremely expensive in its execution, but it would effectually eliminate the rotten planks of the old wharves to which the disease germs cling so pertinaciously. Another plan that has been proposed is to cut a canal connecting the bottom of the harbor with the sea, thereby cutting off the city from the mainland and making an island of it; the theory being that the Gulf Stream could thus be made to scour the harbor. General Sternberg, when questioned concerning this project several years ago, replied that he was not at all sanguine of its practicability, and added, "Havana cannot be cleaned up in a day. In ten years, and with the expenditure of $10,000,000, something really worth while might be done."

The Septic Tank.

At the Pittsburg meeting of the Amer. Ass'n., Prof. L. P. Kinnicutt vindicates the old-fashioned cesspool as equivalent to one of the new methods of treating sewage, under the name of septic tank. He says that the septic tank, about which we have all heard so much, is only a modified cesspool, and the changes brought about in the septic tank are only the changes that occurred in the old-fashioned cesspool of our forefathers, and it is most interesting, as well as somewhat amusing, to see how the old-fashioned cesspool, which only a few years ago was regarded as a breeder of all manner of ills, is now regarded by sanitarians as a most valuable adjunct in the disposal of filth.

A septic tank is only an open or closed tank through which the sewage is run continuously, but at so slow a rate that it requires from twelve to twenty-four hours for it to pass through the tank. The sewage itself, as we have seen, contains anaerobic bacteria, and by allowing the sewage to remain in the tank out of contact of air, these bacteria increase immensely in number, and acting upon the solid and liquid substances in the tank, bring about those changes which are grouped under the name of putrefaction.

In other words, the sewage is purifying itself, or, as Prof. Sedgwick has recently said, we have sewage in the septic tank 'working,' as it were, like apple juice when the latter is being fermented in a cask by wild yeasts In cider-making, sweet apple juice, charged with microorganisms derived from the dust on the skin of the apples, or from the atmosphere, or from the sides of the cask, is slowly worked over by these organisms and turned into hard cider and eventually into vinegar. In a similar way, the sewage in a septic tank, charged with anaerobic bacteria, is worked over, or fermented, by these bacteria, which in this way remove or completely change a large amount of the polluting substances, and give a product which is no longer crude sewage, but a sewage in which a large amount of the solid matter has been liquefied or changed into gas.

Electrical Anæsthesia in Dental Surgery.

During the last few months several announcements have been made of the use of electricity as an aid to dental surgery in the way of producing anæsthesia, deadening live nerves, etc. In one of the methods, the negative side of the circuit is connected to a head piece which has terminals that are placed in contact with each side of the face and held in position by means of a hard-rubber band. The positive side of the circuit is attached to an ordinary dental engine and the current passes through the burr of the drill to the patient.

By means of the apparatus, the inventor says (these statements are given entirely on Mr. McCue's authority), that he short-circuits the pain, or, in other words, succeeds in the removal of exposed nerves by preventing the transmission of the sensation impulses to the brain by short-circuit. This is done by low voltage and high resistance. The storage battery used is made especially for the purpose and consists of 12 cells. All the cells are used in starting, but while operating only one cell producing one volt of electromotive force is used. The current from this cell is cut down to less than one three-hundred-thousandth of its strength by means of a resistance of 300,000 to 400,000 ohms. The current is reduced so fine that Mr. McCue says, as well he may, that he has found no instrument capable of measuring it. Sufficient current is produced, however—perhaps on the homeopathic principle—to enable one to operate on the most sensitive teeth without pain. The inventor himself was the first one to submit to an operation by means of which a live nerve was painlessly removed. Since then many similar operations have been performed, he says, by various dentists with great success. No shock is felt, and it is said that the effect is that of a tonic, the patients getting out of the chair recuperated and refreshed.

Danger in Gas Leaks.

Medical men, in their zeal for the public health, have provided a new argument for the use of electric lighting. They show that the purity of the air in cities is especially affected by leakage in gas mains, which is much greater than is commonly realized, and also that the resulting injury to the public health has been increased by recent changes in processes of gas manufacture. At a recent meeting of the New York County Medical Society the subject was discussed. Some of the facts in the alarming recital may be thus summarized:

There is an immense amount of gas leakage in our large cities. Millions of cubic feet per day are reported to gas-company directors as lost from the mains. The impermeable sidewalk and pavement of asphalt make the ready diffusion of escaped gas into the atmosphere an impossibility in many places. The consequence is the imprisonment of the gas beneath the streets, to find an exit wherever it can into subways, sewers and through the cellar walls of neighboring houses. This produces a condition of affairs that is eminently undesirable. The illuminating gas of the present time is a dangerous poison.

Modern "improvements" in its manufacture have added to its toxic qualities and have rendered it more insidious in its effects. The introduction of the so-called water-gas, now practically exclusively used as the basis of illuminating gas, has cheapened the cost of production, but has greatly added to the amount of carbon monoxide present in gas. This gas is perhaps the most poisonous that human beings may be brought in contact with in ordinary life. There is, therefore, reason for serious concern in relation to the present gas leakage.

Consumption Infectious.

Of all communicable diseases consumption (pulmonary tuberculosis) is the most dangerous. More people contract that disease than any other. The first essential for the restriction of consumption is the general recognition of the truth that consumption is the most dangerous communicable disease. It is lack of caution, because of ignorance of the great truth that consumption is spread from infected persons, that kills off the improperly housed and improperly fed poor. It is ignorance of that great truth that kills off the rich by tubercular disease, in spite of proper housing and proper food.

It is the slow but gradual gaining of that precious knowledge by the common people, and action governed by that knowledge, that is reducing the mortality from consumption. In order to be most useful to the public, it is essential that this knowledge shall be gained by and shall govern the action of every coughing consumptive, who otherwise is a constant source of danger. Therefore the consumptive should be promptly put in possession of that knowledge. Every case of well-developed consumption should be reported, and every case reported should be promptly informed how to avoid reinfection of the patient himself and spreading the disease.

The English Language.

The English language is spoken by 115,000,000 people.

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FIRE-PROOF MATERIAL.

The remarkable advance in building methods of the present age is apparent in nearly every particular except one,—fire-proof building material. That this is an important one, and that the ever present possibility of fire is uppermost in the mind of the architect, engineer or capitalist, is shown by the fact that the Mass. Institute of Technology has recently opened a department for the teaching of fire-proofing methods in building. Many methods for "fire-proofing" wood have been exploited, most of them proving to be a total failure when put to an actual test, while a few of them met with but indifferent success.

A new material, called "uralite," the invention of a Russian artillery officer and chemist named Imschenetzky, seems to meet all requirements, according to report of Consul-General O. J. D. Hughes. Uralite is composed of asbestos fiber, with a proper proportion of silicate and bicarbonate of soda and a small amount of chalk. It is supplied in various finishes and colors, according to its ultimate purpose, and can be supplied in a plastic form for pipe covering if desired. It is a nonconductor of heat and electricity, is practically waterproof, and is not affected by atmospheric influences, nor by the acids contained in smoke in large towns.

Uralite has the further advantages that it can be cut by the usual carpenters' or woodworking tools; it can be painted, grained, polished, and glued together like wood; it can be veneered to form paneling for walls or partitions for ships' cabins or for railway carriages; it does not split when a nail is driven through it; it is not affected when exposed to moisture or great changes of temperature: and it can be given any desired color either in the process of manufacture or afterwards, by the usual methods.

To test the material, a test-house was built of brick, covered with uralite, and containing two doors; one consisted of a thickness of soft uralite in the center, and oak either side, and the other was constructed of oak 1½ inch thick, the panels filled with uralite cement The materials were fixed together by means of nails and screws. A fire was lighted in the house and the doors closed. The highest temperature indicated by the pyrometer was 2,350° F. The fire was left to burn for over an hour, and it was found that the doors had resisted intense heat. Every test showed that wood protected by a covering of uralite remained intact, while portions not so protected were entirely consumed. A room covered (walls, doors, ceiling, and floor) with uralite three thirty-seconds of an inch thick might have its contents burned, it is claimed, without any danger of the fire spreading. If this new material can be supplied in sufficient quantities and at a fair price that is not prohibitive, it will be certainly a boon to mankind, and revolutionize certain phases of building methods.

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THE HEAVENS FOR NOVEMBER.

BY PROF. MALCOLM McNEILL.

Ursa Major is below the pole with the bowl of the dipper east of the north point, while Cassiopeia is above the pole, high up in the northeast near the zenith. Andromeda is in the zenith, Perseus a little farther north and below, with Auriga a little lower than Perseus. The zodiacal constellations are about as they were during October, save that each is about 30° farther west. This brings a new one, Gemini, on the eastern horizon; then come Taurus, Aries, Pisces, Aquarius, with Capricorn setting in the southwest. Orion is rising in the east and farther south, and Cetus is in the southeast low down below Aries and Pisces. Pegasus is high up in the southwest, and Aquila is low down in the west. Cygnus is half way toward the zenith, up in the northwest, with Lyra below it, and Hercules just setting.

Phases of the Moon, Eastern time:

First Quarter,	Nov. 8,	7 h. 30 m. A.M.
Full Moon,	" 15,	12 h. 6 m. P.M.
Last Quarter,	" 22,	2 h. 47 m. A M.
New Moon.	" 29,	9 h. 4 m. P.M.

Mercury is a morning star throughout the month, and until after Nov. 20 it is in fair position for naked eye observation. Until about the middle of the month it rises about an hour and a half before sunrise, and the interval is more than an hour until after Nov. 20. Its greatest west elongation comes on the morning of Nov. 4, and is a little less than 19°, rather a small elongation as compared with the greatest east elongation in September, which was 26°; but the planet is, on Nov. 4, nearly 10° north of the sun, and is consequently very favorably situated for rising a good time before sunrise. It reaches its greatest heliocentric latitude north of the sun shortly after the time of greatest elongation, and this also acts to increase the interval.

Venus will be too near the sun throughout the month to be easily seen. It is a morning star at the beginning, but overtakes and passes the sun on Nov. 28. As it passes superior conjunction it becomes an evening star and will remain as such for the next nine or ten months. It is now in the part of its orbit farthest away from us; and although on account of the relative position of sun, earth, and planet, it will look like a full moon, and we can see practically the whole of the hemisphere which is illuminated by the sun, yet its apparent size is so much smaller than it is when on the near side of its orbit, that it will not be nearly so bright as it is even at greatest elongation, when in the telescope it looks like a half moon.

Mars is still lagging behind the sun and rising earlier,—on Nov. 1 shortly after one o'clock, and on Nov. 30 at about half after twelve. It moves about 15° eastward and 6° southward through the eastern part of Leo, and at the end of the month it is not far from the border of Virgo. It is now beginning to approach the earth quite rapidly, and its distance in millions of miles diminishes from one hundred and seventy to one hundred and forty-six. There is, consequently, a considerable increase in its brightness. On Nov. 1 it is about 40 per cent. brighter than it was when faintest in May last, and at the end of the month it will be 87 per cent. brighter, well on toward the brightness of a first magnitude star. Its ruddy color will also help to identify it; so there will be no difficulty in finding it.

Jupiter still shows as an evening star in the southwest, although much lower than at a corresponding time in October. It sets before 11 P.M, on Nov. 1, and shortly after 9 P.M. on Nov. 30. So it is still high enough to be well seen in the early evening. It is in the constellation Capricorn, and is moving eastward. After moving quite slowly throughout October, it has now begun to make more rapid progress, and covers 4° during the month.

Saturn is also in the same part of the sky, but as it precedes Jupiter about 17°, it sets more than an hour earlier, at half after nine on Nov. 1, and before eight on Dec. 1. It is therefore getting rather low for good naked eye view, but still can be readily made out. It is still in the western part of Capricorn, and moves about 2° eastward during the month. The distance between the planets increases by about the same amount, and they can scarcely be called neighbors any longer.

Uranus is also in the southwestern sky in the evening, but is lower down than Saturn. By the end of the month it sets less than an hour after sunset, and there will be no chance again to see it with the naked eye until it has reached a considerable distance west from the sun as a morning star.

Neptune is in the constellation Gemini and rises before very late in the evening, but it takes a good telescope to show it.

Correspondence

An Odd Wish.

Editor Popular Science News:

There is an incident connected with the collection of Colonel John Trumbull's paintings in the Yale School of Fine Arts, which is not generally known. Col. Trumbull bequeathed to Yale the collection of his original paintings, upon the condition that he was to be buried beneath them, in a vault underneath the building in which the pictures were hung. This building, the office of the treasurer of Yale University, was then used as an art gallery. In the bequest a provision was made, to the effect that in order for Yale to keep possession of the paintings, his body must remain buried beneath the pictures.

The will was carried out, but when, in 1867, the present art school was ready for use, it seemed more reasonable to the committee in charge, that all the paintings of the university should be gathered together in one place. But according to the agreement, the pictures could not be moved from the vicinity of Col. Trumbull's tomb. So it was decided to move the pictures into the south gallery of the art school, where they now hang, and also to move Col. Trumbull's body to a new resting place beneath the south wing.

Part of the floor of my father's laboratory in the Treasury building was taken up, and the large slab covering the vault was lifted. The coffin, or more correctly, the fragments of it, were transferred to the new grave, thus carrying out the letter of the bequest. A tablet in the basement modelling room bears the following inscription, in reference to the death of Col. Trumbull:

COL. JOHN TRUMBULL,
PATRIOT AND ARTIST.
FRIEND AND AIDE
OF
WASHINGTON,
LIES BESIDE HIS WIFE,
BENEATH THIS
GALLERY OF ART.
LEBANON 1756. NEW YORK 1843.

Since the removal of the paintings from the Treasury building, the Yale campus has been changed by the demolition of several buildings, among them the treasurer's office; so that the exact site of Col. Trumbull's first burial place is quite obliterated. The collection of paintings by Col. Trumbull is an extensive one, including most of his famous works. A large portrait of General Washington is placed in the center of the group, while around it are arranged battle paintings and portraits of world-known generals and statesmen.

Prof. Weir, Director of the Yale School of Fine Arts, has, during the last year, published a most interesting book on Col. Trumbull. To historians and artists who are interested in the life and work of prominent men among our own Americans, the Trumbull gallery of paintings and the study of his brilliant life will ever have a charm which is all its own.

L. Lavinia Verrill.

Danger of Licking Stamps.

Editor Popular Science News:

Is there a person anywhere who does not lick a postage stamp before applying it to a letter? Is there a post office clerk anywhere in the universe who does not slide out purchased stamps with the gum side down on the window board, which is smudgy with thousands of human paws? For one, it has long been my habit to wet my finger and apply it to a stamp.

It is not so generally known as it ought to be that the licking of stamps may be followed by tubercular disease. Dr. Busquet, a surgeon-major in the French Army, and engaged in the bacteriological laboratory attached to a military hospital in Algiers, received for treatment a young soldier far advanced in tuberculous disease of the lungs. The soldier was a collector of foreign stamps. Unused stamps he generally fixed in his album by licking them. In order to test some stamps, Dr. Busquet bought three hundred for his patient, many of which were for the purpose of exchange. These stamps were placed in sterilized water At the end of twenty-four hours, Busquet inoculated guinea pigs with the water. Of eight animals thus treated, all became tuberculous. Schoolboys and girls form the larger number of philatelists, and, as they often wet the stamps with the tongue, the danger incidental to this practice is apparent.

Disgust.

Young Grasshoppers.

Editor Popular Science News:

Little grasshoppers always amuse me. Somehow they seem more like human babies than the young of insects. You see, the grasshoppers have no caterpillar stage and no chrysalis like the butterflies, so that the little fellows are very much like the big ones, only more roly-poly and and top-heavy, like little Brownies.

The small chaps are brown or else light green, just the color of the grass; they have no wings and their abdomens are made up of fewer rings than are those of adults. But they have appetites like growing boys, and they keep shedding their skins and growing and getting more joints in their bodies until, when they are almost grown, little stumps of wings begin to appear. Ater this, they moult a few more times, and at last the full-grown locust crawls out of his skin, wings and all. But he keeps his youthful appetite to the last, so that a swarm of these creatures will devour every green thing and leave the country a desert.

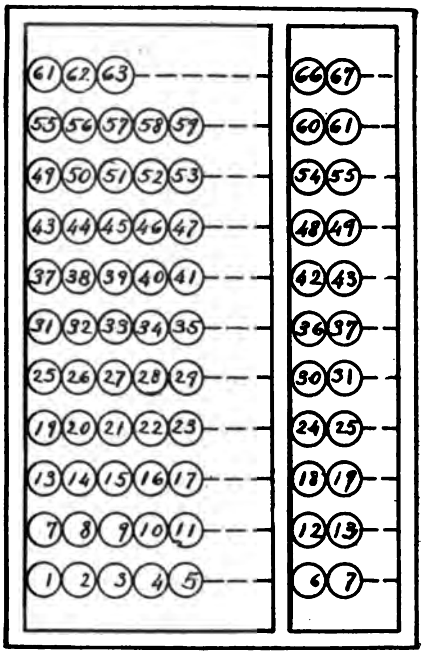
E. T. Brewster.

Calculating Device

Editor Popular Science News:

Herewith is a diagram of a Chinese calculating arrangement that is more or less common anywhere. The circles represent beads sliding on rods (represented by dotted lines) mounted in a frame.

Can anyone explain how these devices are used? I have asked several Chinese persons, but they either cannot or will not explain it. If the beads are numbered, as in the diagram, the first, fifth and seventh rows contain all of the prime numbers and their multiples above five.



Math.

Pre-Historic Remains of Northern Mich.

Editor Popular Science News:

Numerous relics of the aboriginal tribes are found in this section of the country, but so far but few ceremonial objects of any description have been discovered. Nearly all the stone objects seem to have been for practical use and not for ceremony or personal ornament—if perhaps we may except a few pipes which were probably used in some ceremonies.

But this lack of ornaments for personal adornment does not imply a lack of love for the beautiful, since most of the pottery fragments are quite artistically decorated by indentations made by pressing the soft clay before baking or drying, with the aid of stones, sticks, and in some cases the fingers, as the imprint of the old potters' finger nails are distinctly visible.

The relics of stone, including arrow and lance points, knives, drills, scrapers, axes, celts, etc., show fine workmanship, proving that the ancient race, whoever they were, had reached an advanced stage in art of stone chipping and polishing. In the lakes (little and big clam lakes) are found numerous clams, and on the banks are found many shell heaps attesting the fact that here ancient man held many a savage feast. These shell heaps sometimes yields fragments of decorated pottery of varied design, hardly any two pieces showing a like pattern.

I have discovered several arrow points—which are described as rare in classification of stone relics, such as double-notched base lance point, war points with concave bases, rotary points, etc., enough to show that some of the finest specimens of aboriginal work can be found in northern Michigan. Spear points of more than four inches in length are very rare.

Grooved axes also are rarely found, but the few which have been found are of fine workmanship.

I have recently found a few very small stone (flint) implements, the use of which I do not know. Perhaps they were used in surgery. Of course, we can not place ourselves in the position of primitive man in any way, and many times, probably, have a theory in regard to the use of an implement, which was undreamed of by the ancient race who used it.

The study of these wasting relics of a forgotten race is one of the most interesting and fascinating of the sciences. And so in our spare time, we explore their graves and village sites and try to read their past history in their relics; we try to see these people as they once lived and—died, ere the waves of time and oblivion closed over them and they perished forever from the face of the earth.

Chas. W. Manktelow.

The Great Horned Owl.

Editor Popular Science News:

When the sun has set and the shadows deepen about us, the Great Horned Owl leaves his retreat among the tamaracks, and sallies out in search of food. His flight is strong, almost brisk, but noiseless as the darkness itself; he flies through the thick woods with as much ease as if there were not a branch within a mile of him.

When he gains the open or rises above the trees, he sails now and then very much like a hawk. Woe to the chicken that perches out of doors when this owl comes his way, for there will be a quick blow, a whirl of feathers, and a chicken supper for the owl. This owl is very fond of chicken and does some damage to the poultry yards, and has won the ill will of the farmers for that reason, but he is more of a friend than an enemy, in spite of his love for fowl. He kills untold numbers of field mice, gophers and other enemies of the farmer.

The Great Horned Owl cares nothing for the cold, and has been known to nest in Minnesota as early as February 7th. The nest is placed in the top of a tall tree in the dense woods, far from habitation as possible. It is composed first of a layer of sticks, then a layer of twigs and rootlets, with a lining of moss and leaves. The eggs are three or four in number and range from white to yellow in color. While this owl is nocturnal in habits, it can see, though not very well, in the daylight.

I was creeping through a tamarack swamp after partridges one day, in the fall, when I almost ran into a big fellow that was seated in a tree a few feet above me; he glared at me a moment or two with his half-open eyes, then flew slowly away. There is a contrast between the swift, sure flight in the darkness and the slow, careful flight in the daylight that is very noticeable.

This owl gets its name from the large ear tufts on either side of the head.

C. William Gross.

Horned Larks in Utah.

Editor Popular Science News:

In northeastern Utah there was at least one bird that reminded us of our Illinois home—the horned lark (Alauda alpestris); pre-eminently a home bird is he. A heavy snow fell during the first days of February, 1901, and thereafter these birds were more noticeably abundnnt than before. Wherever found their habits are the same, and they get their living in a primitive sort of way, flying in flocks over the mesas of Utah, the prairies of the Dakotas, or the meadows of Illinois in quest of the seeds of weeds and other plants; hence, being most democratic in habits, they are the same birds everywhere. With many kinds of birds, too, a difference in latitude or longitude of habitat implies a difference, in some degree, at least, in song. But I could not detect the slightest difference in the notes of those larks flying over the Uinta plains from those of the birds I had heard for years in central Illinois or in Minnesota.

When the snow covered the ground to the depth of several inches, numbers of these birds came close to the government buildings to hunt for food on the spots near thereto which were bare of snow. Here the Ute boys—who are murderous little wretches—kill them in various ways; by shooting them with arrows, hitting them with stones, or in some other way after snaring them in horehair nooses. This method of capture may be described as follows: The boys procure long hairs from horses' tails or manes, and, with a single hair for each snare, form slip-nooses three or four inches in diameter; several of these nooses are fastened to a stick, after which the whole contrivance is laid upon one of the bare spots in the field of snow.

A handful of oats is then scattered about to attract the birds. The lark walks into a noose and is caught by the foot. The first bird that I saw caught flew several feet, dragging the stick (which was a little larger in diameter than a lead pencil, and about one and one-half feet long) over the snow. Fate decreed that the hair should slip, and the bird was free. But many are less fortunate, and meet a cruel fate through this heartless trap.

H. Tullsen.

Questions & Answers

QUESTIONS NOT ANSWERED.

Answers are solicited, especially for all questions so far without replies. Questions will appear but twice, successively. The following questions need reply—378, 401.

403. Blacksnakes and Mice. Is not a blacksnake a good substitute for a cat? We found one in our cellar and have not sought to kill him. No evidence of mice has has been noticed since his snakeship made his appearance. Country.

404. Sunflowers of various size. One of mine has flowers five or six inches in diameter of disk, at top, down to one inch on lower side-stems. Is this common, and do the varieties of sunflowers of all sizes originate in this way? I know that there are species in nature of varying size, some very small, but I speak of the numerous sorts of the cultivated. Janet.

405. Japanese Hydrangea Colors. My H. paniculata grandiflora is turning a brownish green, this Sept. 6th. Will any one who is long familiar with this plant inform me if it is due to a wet season,—the change having been to red for several drier seasons. Also, does the humid summer account for the browning and falling of many Paulownia leaves, probably from a fungus? Janet.

406. Horses and Heat. When a horse is hitched in the street, exposed to a hot sun for hours, ready for immediate use, does he not suffer more in health and comfort than if he were in a stable; and in which of the two situations is he most annoyed by flies? This inquiry is to settle a dispute. Observer.

407. Boiling Potatoes. Is anything gained by violent boiling? Can the water and steam in an open vessel be raised above 212° Fahr. C. J.

408. Studies in Drawing. What published series of trees and animals are available and most useful in the practice of drawing? Texas.

409. Tarnished Silver. Why does plated ware turn to all colors of the rainbow when standing long without polishing? M.

410. Old Exposed Paint. Why does this become lighter in color, whatever the original color may be? M.

411. Fruit Abundance. To what may the excessive abundance of fruit this year be attributed, e. g., berries and grapes? Suburb.

412. Grapes and Jelly. Is it known generally that green grapes, even half grown, make good jelly, and that, by so using them, the superabundant fruit can be thinned out, so that what remains will ripen better and larger? Suburb.

413. Dangers of Football. Should not the piling of the players on each other in a heap be prohibited by law, or be reason for arrest under some existing law that concerns disorder or assault? I have repeatedly seen persons injured in this way; sometimes death results. A. T. F.

414. **Asthmatic Breathing.** If every disease has a remedy, what is the remedy for asthmatic breathing accompanied by palpitation, shortness of breath and extreme exhaustion on slight exercise? K.

415. **Hot-Air Balloons.** 1. What is the lifting capacity of ordinary hot-air type per cubic yard? 2. At what temperature are they inflated? 3. What would be the cost of such a balloon (silk envelope) large enough to lift 400 lbs., exclusive of its own weight? 4. Using kerosene oil to furnish heat, how much would be required to inflate the balloon and how long would it remain afloat? 5. Aside from fire are there any disadvantages peculiar to hot-air balloons? 6. What is the relative heat producing value of kerosene, gasoline and alcohol? HOMER W. JACKSON.

416. **The Sun's Displacement.** Is the entire sun visible by refraction, ever, after it has really set? And why does it often seem flattened? SOL.

417. **Bloom on Fruit and Sea.** What is the cause and nature of the bloom on ripe grapes and plums, etc., and also on the surface of the sea at a distance?

JOHN K. LEADER.

418. **Wigwagging of Leaves.** I notice frequently that a leaf will wigwag, perhaps very actively, while the other leaves are quiet; then it will cease, and some other leaf will begin the same performance. How can this be accounted for? It seems almost supernatural. J. K. L.

419. **Rain Drops on Leaves.** Why do rain drops or dew drops on certain leaves assume a spherical shape, and with a pearly lustre? It is not so on all plants.

J. K. L.

420. **Lightning.** Is lightning always instantaneous, from cloud to earth? Some authorities say so, but I do not believe it.

WILHELM ERNST.

421. **Razor Strop Paste.** How is razor strop paste made? F. P.

422. **Enlarging a Negative.** I would like to know what is the simplest method of doing this, by the amateur, if he can do it with his usual camera. W.

423. **Grafting Plum Trees.** How can this best be done, or effectually?

SUBURB.

424. **Cramps.** I am troubled with cramps in the feet and legs, especially after retiring at night. Can any one give the cause and cure? G. T. T.

425. **Duplicator.** What is the best recipe for a duplicator and for duplicating ink? A TEACHER.

426. **Lightest Wood.** Can some one of your readers tell us what kind of wood is the lightest? FORESTER.

427. **Fireproof Wood.** What is the best method of rendering wood incombustible? Will coating of silicate of soda do it? I have some floor joist laid against a chimney which sometimes get quite hot. I want to make them fireproof. H.

ANSWERS.

383. **Pipe-Stem.** Amber may be slowly bent into any required shape, by heating to the proper temperature. The hole is bored or burned through the material and then bent. The hole through the bowl of the pipe is often straight, though in some cases, the pipe-stem may be bored before bending. NICK O'TEEN.

387. **Pink Clover.** I am glad to see that Mr. Plitt answers satisfactorily this question, as I have not a late edition of Gray's Manual. It is certainly distinct from the common white clover, in its much greater in height, somewhat different in the shape of the leaves; and also its color, though white clover often, and after a while, turns pink. The habit of the older outside florets becoming brown and very much reflected, in the same, however.

SUBURBAN.

391. **Stammering.** A gentleman who stammered from childhood almost up to manhood gives a very simple remedy for the misfortune:—Go into a room where you will be quiet and alone, get some book that will interest but not excite you, and sit down and read two hours aloud to yourself, keeping your teeth together. Do the same thing every two or three days, or once a week if very tiresome, always taking care to read slowly and distinctly, moving the lips, but not the teeth. Then, when conversing with others, try to speak as slowly and distinctly as possible, and make up your mind that you will not stammer.

Well, I tried this remedy, not having much faith in it, I must confess, but willing to do anything to cure myself of such an annoying difficulty. I read for two hours aloud with my teeth together. The first result was to make my tongue and jaws ache, that is, while I was reading, and the next to make me feel as if something had loosened my talking apparatus, for I could speak with less difficulty immediately. The change was so great that everyone who knew me remarked it. I repeated the remedy every five or six days for a month, and then at longer intervals till cured. DOCTOR.

395. **The Malarial Microbe.** In spite of the deplorable "answer" given on page 239, October, doctors do agree that the only microbe which does or can cause malaria is an animal belonging to the class Protozoa, and known as Plasmodium malariæ. The first stage of its life is passed in the salivary glands and blood of mosquitoes belonging to the genus Anopheles; these exceedingly minute, spindle-shaped "blasts" pass out in the poisonous saliva during the act of "biting," and thus enter the blood of the human subject. Their second (or third?) stage is passed in the red corpuscles, which are ruptured and destroyed by the growth of the parasite; it is possible that the "blasts" may reproduce by fission just before entering the red corpuscles. Next comes the "spore" stage, each parasite breaking up into a multitude of rounded, spore-like bodies; and if these "spores" happen to be imbibed by a mosquito of the right species, further transformations and finally reproduction take place; and thus the cycle is finished—around to the "spindle blasts" again.

The details of this extremely important matter have been known only a few years, though the truth was suspected long ago. A variety or sub-species, known as Plasmodium malariæ equorum, has recently been described as the cause of equine malaria.

The life history of this fearful animal is somewhat complex, but no more so than that of thousands of other mighty mites that shape our destinies ever.

BIOLOGIST.

398. **English Bookbinding.** It seems to me likely that much of the rupture of cover hinges is due to a thoughtless habit of bending back the covers too far, or permitting one or the other cover to lop backwards while reading. There should be invisible spirits to snatch away the book from so careless hands. In this connection, I recall the affectation of choir singers everywhere—a choir disease—of bending hymn books back to back. Perhaps they are always hungry for a new set of books; but it is ridiculous.

CHURCHGOER.

398. **English Bookbinding.** The answers given to this in your September number are good, but what shall we say to some American binding?—especially what is termed morocco or Turkey in many instances. It is not so durable as cloth, and is evidently "split leather," as it is called. It is very thin and about as fragile as paper, after the book is used awhile; yet for such binding the publisher asks as much as 50 cents extra. It is a humbug, to use one of your Yankee words. The man who invented a machine for splitting leather (used for many purposes, even slippers) ought to be immortalized in a Hall of Infamy. He must have known that he was inventing a fraud.

I have been cheated even in a $3.50 morocco blank book, made to my order. Probably, or possibly, the costly editions de luxe have honest binding, for the behoof of those who can afford the high price. But I have some old leather bound books, dating back 70 or 90 years ago, that have been used much and show no signs of breaking at the hinges and tops. Perhaps the users had common sense enough to push sidewise a book in the library and draw it out by thumb and finger on the sides, instead of pulling it forth by finger on top of the back.

JOHN BULL.

399. **Blackberries.** One might answer simply that it is the nature of blackberries, and raspberries as well. In nature we find all plants suited to certain native

situations. These berry bushes, unlike some others, are found along the edges of groves, in their perfection. But, if one seeks for a reason, it may be in the word moisture. Hence, if the ground be thickly mulched with straw or grass, it retains moisture, and the mulching keeps down weeds and grass itself. Try it, if your berry bushes do not yield well-developed fruit. John Doe.

400. Insects in Wet Seasons. I have noticed the comparative scarcity of some species this rainy season. For example, none of the web-worms on my "sorrel tree" (Oxydendron), beautiful for its autumnal crimson leaves; but perhaps because I destroyed the worms last year.

Cottager.

405. Japanese Hydrangea Colors. I imagine that, by this time, late in September, Janet finds that this magnificent shrub has its big trusses as red as ever. Mine, like others, were greenish at the time she mentions, but by the middle of that month began to redden and now in early October have become deep red.

Cottager.

407. Boiling Potatoes. Certainly, the water and steam do not rise above 212° in an open vessel; but the "violent boiling" may produce so much steam that the potatoes are steam-cooked, the slow boiling water being less penetrating.

Phil Osopher.

408. Studies in Drawing. The inquirer can presumably get a reply from the great art stores in the cities; probably French and German sets are now obtainable.

Amateur

409. Tarnished Silver. Mrs. White gave a good answer in the September number of Popular Science News, but the new question in the October number about "all colors of the rainbow," deals with effects that are doubtless due to the thinness of the pellicle of tarnish, in some places admitting internal reflection of one wave-length of red rays, in another blue rays only, without conversion of the ray into another. Sir Isaac Newton, I believe, explained this in an experiment where the pressing, more or less, of one disk of glass on another, produced changing rings of color. It is a very common phenomenon, seen in cracks of ice, vapor on window, the thin coating of glass added to make iridescent glass vases, etc.

Phil Osopher.

410. Old Exposed Paint. It is the simple fact that the oil is gradually oxidized by the atmosphere, so that the color of the paint powder only remains, and this is usually lighter than the powder mixed with oil, just as any color is when wet with anything. Perhaps this is the reason for the old fashioned preference for white houses; the white is still white after the oil is oxidized away. I happened to know personally an oil manufacturer, and by request got from him some genuine boiled oil, and the dove color I used for a house remained true and glossy for years. Much of the so-called boiled oil is said to be a cheap mixture with resin, to thicken and darken it so as to pass it off as the genuine boiled. D. C.

411. Fruit Abundance. It may be the wet year, or a method of trimming or fertilizing, or it may be a short crop of grapes and berries the previous year.

Gardener.

Animal with Three Eyes.

Nearly every one has heard of the tuatara, the curious, iguana-like looking creature, now found on only one or two islands off the coast of New Zealand, and supposed to be the oldest living type of animal on the face of the globe. One of the most curious features is an organ on the head, which at one time was spoken of as the pineal gland, but which Dr. Dendy discovered to be in reality a third eye. His paper on the subject caused the greatest interest in the English scientific circles.

More recently Dr. Dendy has discovered another New Zealand creature possessing a third eye. This is the New Zealand lamprey, a favorite article of food among the Maoris. The third eye is situated right on top of the head and is covered with a thin coating of skin. It is doubtful whether it is now of any practical use for seeing, but Dr. Dendy believes that at one time, far back in the world's history, there were two eyes on the back of the lamprey's head. He is further of the opinion that at one time the tuatara also had two eyes where now only one remains. In the tuatara it is the left eye which has survived, while in the lamprey it is the right one.

"Summer Complaint" Germ.

Dr. William H. Welch, director of the Rockefeller Institute for Medical Research, announces a discovery which promises to be of illimitable value as regards the prevention and treatment of intestinal diseases of children. After years of investigation and study the microbe which causes summer complaint in children has been isolated as a result of work recently carried on at the laboratory of the Wilson Sanitarium for Children, where there are 300 to 400 children suffering from intestinal trouble during the summer. The organism found was identical with that which causes acute dysentery (flux) in adults.

Mr. Rockefeller was moved to establish this institute by the death of his grandchild from cholera infantum.

Growing Sponges.

The U. S. fish commission experts are at work among the Florida keys trying to get sponges to growing more satisfactorily there. At present five different varieties of sponges are found off the south Florida coast, and it is believed that the sponge industry is in a fair way to be greatly extended.

Current Mention

The Epiornis.

Is this gigantic bird of Madagascar still living? Its bones are well known, and its eggs which are equal in capacity to twelve dozen hen's eggs. A French society is to undertake a search for the living bird. The story that this enormous creature still stalks in the primeval wilderness is one that comes year by year out of that land. Some scientists have not hesitated to admit that it might be true. There is nothing inherently impossible about it.

The Trial by Fire-Walk.

Through French translation, comes the report of John Piddington on this subject, of which an account has been given by observers in former numbers of this journal. It has been a mystery for ages and practiced in many lands.—this religious ceremony of walking across a pit of hot stones, even red-hot; and observers have testified that the feet are not burned. Mr. Piddington gives the testimony of a Mahometan in his service for twenty years in the island of Mauritius, and never found untruthful.

The substance of it is that the fire pit is less large than often reported; it is less a matter of hot stones than of burning coals, which are carefully raked off; there is a pool of water when the devotee starts and another where he leaves the pit, and wet feet render him comparatively immune. He is wrought up for two weeks by a superstitious frenzy. It is said the feet are prepared by treatment with alum; but, however this may be, the feet of these natives, who go barefoot, have thick hardened soles. Still the feet are blistered, and are treated with an astringent of leaves and with cocoanut oil, soon becoming healed. But all this may be only local, not invalidating other testimonies.

Some Manufacturing Statistics.

Troy makes 85 per cent. of the linen collars and cuffs used in the United States; Baltimore cans 64 per cent. of the oysters· Gloversville and its neighbors make 54 per cent. of the gloves; Connellsville district, 48 per cent. of the coke; Waterbury, 47 per cent. of the brassware; Philadelphia, 45 per cent. of the carpets; Providence and its vicinity, 45 per cent. of the jewelry and 36 per cent. of the silverware; Chicago slaughters 35 per cent. of the meat and makes 24 per cent. of the agricultural implements; Meriden makes 32 per cent. of the plated ware, and Paterson 24 per cent. of the silk.

Copper.

The most economical processes are used in the Lake region for the recovery of copper, so that it is found that ore yielding one and one-half per cent. will pay costs

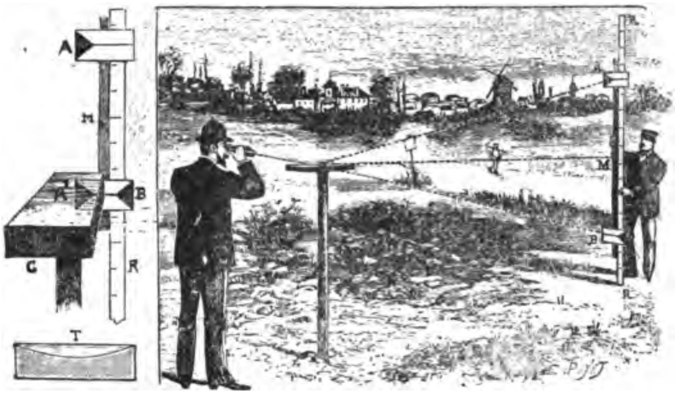
A NEW WAY TO OBTAIN LEVELS.

Eugene Jeyeux, a surveyor at Sèvres, says Public Opinion in translation from La Nature, has just discovered a new system for obtaining levels, based on two well-known physical phenomena, namely, the perfect horizontality of the surface of a liquid in repose and the equality of the angles of incidence and reflection of a luminous ray which meets a uniform surface.

The level is composed of a basin C, made of gutta percha or blackened wood, 20 or 25 centimeters in length by 8 in width, and only 4 or 5 millimeters in depth, hollowed as is indicated in the cross-section T. This basin is placed on any support about one and one-half meters from the ground, and a divided rule R is used on which moves a slide vane with two sights A and B fixed to the ends of a rod which has in the middle a line M. This line should be exactly at an equal distance from the fiducial lines placed on the sights.

The basin having been suitably placed and filled with water to the edge, now constitutes a perfect horizontal mirror, and if the operator directs the basin lengthwise toward the rod with the slide vane, which rod is held vertically, he perceives at one and the same time one-half of the sight B and the image A-1 of the opposite half of the sight A. By raising or lowering the slide vane according as the image appears above or below the sight B, the operator quickly places the vane *au point*, that is to say, brings the image and the sight B to exactly the same height so that the fiducial lines appear as the prolongation of each other. By looking with both eyes the surveyor should see both lines clearly superimposed forming but one straight horizontal line.

In this particular position it is evident that the line M is in the plane of the mirror; that it is exactly on a level with the water in the basin. It is to be observed that when the slide vane is lowered or raised, this latter being *au point*, there is produced between the fiducial lines of the image A-1 and of the sight B a deviation double the displacement of the slide vane, and therefore an error in observing the fiducial lines only produces for the point M an error one half as great. When the slide vane is a little distant in order to carefully observe the fiducial lines and to make sure of the superimposition it is well to employ field glasses, the glasses having the advantage also of clearing the edge of the mirror of the light produced by capillary action.



ILLUSTRATING THE JEYEUX SYSTEM.

Printing in Persia.

Printing from type in Persia is not regarded with popularity. This country is at the present day entirely dependent upon lithography for the native production of books and journals—which are very rare A short time ago a press with movable types was set up, and upon which a certain number of books were printed. The effort, however, met with no encouragement, and had to be abandoned. The unpopularity of type-printing in Persia is due to two principal causes: First, the straightness of the lines offends a Persian's artistic taste, and, secondly, in printed books the character of the letters is entirely lost. The Persian reader prefers a well-written manuscript, and, failing this, he contents himself with a lithograph, which is usually the facsimile of the writing of some fairly good scribe.

A Power of 1,000 Diameters.

Both microscopists and astronomers are in the habit of speaking and writing in a very offhand manner of a power of 1,000 diameters; but very few persons really comprehend the meaning of so great an enlargement.

An instance of what such magnification means is furnished by considering its effect upon a house. Take one that is 30 feet square; if magnified 1,000 diameters it would cover 33 square miles. Again, an astronomical instance: If the sun or moon be magnified 1,000 diameters it would fill the firmament about 1⅛ times and leave no interspaces.

Study of Rainfall.

A table is published in the last issue of the Monthly Weather Bureau giving the average annual precipitation at various stations in the United States. The table for the most part is based on official Weather Bureau readings for from thirty to forty years. In the case of Philadelphia, however—due no doubt to the scientific interest that centred there owing to the residence of that versatile genius, Franklin—records are available for the past eighty-five years. The completeness of these records is not equaled by any other observation station in the whole country, though Boston is a very close second. During these four-score years the average annual rainfall has been 41.47 inches.

This table, which is probably the most complete ever published, shows very clearly that local orography has a decided influence on rainfall. A careful study of these figures discloses the fact that the Pacific coast presents the greatest and least, and what is more remarkable, these two extremes occur at the same longitude and within eight degrees of latitude. The driest spot of which there are official observations is at Newman, in California, where during twelve years there has only been an average of 1.23 inches of precipitation per year. This desert spot has a latitude of 37 and longitude of 121. Mammoth Tank, perhaps named in irony, in California, is nearly as dry, with only 1.81 inches. In fact, there are a greater number of remarkably dry stations reported in California than in any other state On the other hand, the greatest rainfalls are in Oregon. A little place called Glenora possesses the distinction of having 135.84 inches of rain annually, or more than one-third of an inch every day in the year, not, however, that it rains every day in the year. The latitude of this place is 45 and the longitude 123. Government Camp, in the same latitude, but longitude 121 degrees, 50 minutes, is nearly as wet, with 103 56 inches. The only other three-figure rainfall station is in the state of Washington, at Neah Bay, where the average for eighteen years is 122.40 inches. A remarkable illustration of the influence of the physical character of locality on rainfall is found in the fact that Moxee Valley, only two degrees different in longitude and letitude from Neah Bay, has an annual precipitation of only 8.62 inches.

A very pretty illustration of the influence of local topography on rainfall is to be found in the records for the island of Ascension, which lies in the southeast trade wind region. This island consists of a huge mountain, known as Green Mountain, and a lowland lying to the west of the mountain. It is very rare, says Prof. Cleveland Abbe, for rain to fall on the lower part of the island, owing to its position to the leeward of the southeast trade winds. The latter are deflected up the slope of the mountain, and cooling at the summit, abundant clouds are formed, but no rain falls. On the other hand, the summit of Green Mountain is enveloped in clouds, and is remarkably verdant. The drip from the leaves and twigs on the mountain top is carefully preserved for the use of the naval garrison at the landing on the leeward side of the island.

In this same connection, Mr. Henry Gannett calls attention to an error commonly taught in the schools of to-day, namely, that the presence or absence of forests has an influence upon the amount of rainfall. He says that some keen observer long ago noted that forest regions enjoy a heavier rainfall than those not forested, and jumped to the conclusion that rainfall is produced by forests, with the corresponding corollary that the removal of forests diminishes the rainfall. The truth of the matter, as recognized by the leading modern physical geographers, is that the want of rain prevents the growth of forests and not that the want of trees prevents rain.

Invisibility of Transparent Objects.

A transparent body, no matter what its shape, disappears when immersed in a medium of the same refractive index and dispersion. Could a transparent solid substance be found whose refractive index and dispersion were the same as those of air, it would be absolutely invisible. We can find a solid, the refractive index of which is equal to that of air for light of a certain wave-length, but, unfortunately, it is not a transparent substance. If it were, we should have an example of a solid absolutely invisible when illuminated with monochromatic light. The dispersion curves of some of the aniline dyes cross the line of refractive index for certain wave-lengths, but the point of crossing is in the immediate vicinity of the absorption band.

The disappearance of a transparent substance when immersed in a medium of identical optical properties is usually illustrated by dipping a glass rod into Canada balsam, but the disappearance is not complete, for the dispersion of the glass and the liquid are not the same. A better fluid is a solution of chloral hydrate in glycerine, which is quite colorless. The glycerine is to be heated and the crystals added until the refractive index is of the required value. The hot liquid will dissolve a most astonishing amount of the chloral, ten or fifteen times its bulk, if I remember right, and only a very small amount should be placed in the beaker to start with. This solution has almost exactly the same dispersion as glass, and finely powdered glass stirred up in it becomes perfectly transparent without showing a trace of Christiansen's colors. A glass rod disappears completely when dropped into it, and when withdrawn presents a curious aspect, for the end appears to melt and run freely in drops.

Lord Rayleigh, in his article on optics in the "Encyclopædia Britannica," points out that perfectly transparent objects are only visible in virtue of non-uniform illumination, and that in uniform illumination they would become absolutely invisible. A condition approaching uniform illumination might, he says, be attained on the top or a monument in a dense fog. I have recently devised a method by which uniform illumination can be very easily obtained, and the disappearance of transparent objects when illuminated by it illustrated. The method in brief is to place the object within a hollow globe, the interior surface of which is painted with Balmain's luminous paint, and view the interior through a small hole.

The apparatus can be made in a few minutes in the following manner: A quantity of Canada balsam is boiled down, until a drop placed on cold glass solidifies. The Balmain paint, in the form of a dry powder, is stirred into the hot balsam until the whole has the consistency of thick paint. Two glass evaporating dishes of equal size are carefully cleaned and warmed and coated on the outside with the hot mixture, which can be flowed over the glass, and by the dexterous manipulation of a small Bunsen flame made to cover the entire outer surface. I first tried painting the inside of a copper sphere with the commercial paint, but the surface was unsatisfactory, and could not be easily cleaned. Probably two perfectly plain hemispherical finger-bowls could be used instead of the evaporating dishes. As soon as the coating has become hard, a small hole is cut through it, to enable the interior to be viewed. If the lips of the dishes are placed together, the interior can be seen through the small opening; but in this case the line of junction, which is always more or less dark, comes opposite the aperture.

If the inner surfaces be exposed to bright daylight, sun, or electric light, and the apparatus taken into a dark room, a crystal ball, or the cut-glass stopper of a decanter, placed inside, it will be found to be quite invisible when viewed through the small aperture. A uniform blue glow fills the interior of the ball, and only the most careful scrutiny reveals the presence of a solid object within it. One or two of the side facets of the stopper may appear if they happen to reflect or show by refraction any portion of the line of junction of the two hemispheres.—Prof. R. W. Wood, in the Physical Review.

Calls for Scientific Books.

In a list showing the comparative number of scientific books issued by city libraries, Los Angeles, Cal., stands first, 11.4 per cent. of the calls being for scientific works. Salem, Mass., is the lowest.

BOOK NOTICES.

Caterpillars and their Moths. By Ida Mitchell Eliot and Caroline Gray Soule. Illustrated from photographs, 8vo, 300 pages of text and 80 insets. New York: The Century Co. The peculiar value of this book lies in the fact that it is built up not of theories nor generalizations nor of second-hand information, but is strictly a record, in exact statement, of the authors' own experiences and experiments, aided by careful reference to the standard works on the subject.

Unique is the photographic presentment, in life-size, of forty-three species (which may be found throughout a wide range of our country), to which is added the life-history of at least one of each species. There is shown also a picture of the larva and the moth in each case.

The authors have put into the book all the facts needed for the successful rearing of moths, as much structural work as beginners need to know, an account of the necessary appliances and equipment, together with a list of the most useful reference books.

This volume will not be found to contain full details of internal structure or function, but only such as affect the rearing of larvæ or the treatment of eggs, pupæ, or moths.

This is "a true book," and cannot help but be a very useful one. It is fascinating reading, as is any chronicle of the intimate observation and study of insect life.

Quid Est. By Elizabeth Mariner Scarritt. The Abbey Press, 114 Fifth ave., New York. Pp. 172. 1892. This daintily linen-bound volume is a story of Italy, with the story continued in New Orleans. It is the tale of a princely family, with a mystery solved at last and the heroes and heroines passing through trials to a happy dénouement. The interest is maintained by stirring incidents, from first to last; the villain involved meets his fitting fate.

Throughout there is a glow of description and felicity of style that gives zest to the banquet, aside from the stirring events of the narrative. Mrs. Scarritt, whose husband is the scholarly rector of a church in St. Louis, is known in the east and the west as a superb singer; and there is music in her writing. She certainly has the knack of writing good fiction; and her book justifies the hope of good things to come from her pen.

The American Date Book. A handbook of reference relating to the United States of America. By W. E. Simonds. Cloth, pp. 210. Hartford: The Kama Company. A very useful work for writers, politicians, librarians, instructors and students. It classifies United States history under eighty-one heads, so that any date may be found in an instant. But few persons have the faculty for remembering dates; for others the Date Book placed conveniently on the desk will be a friend indeed.

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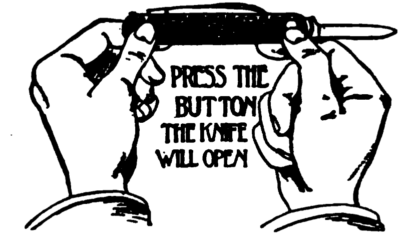
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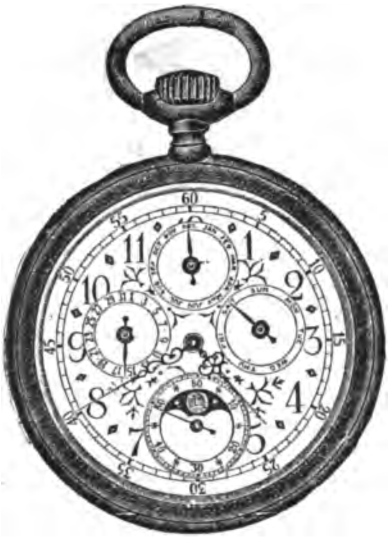

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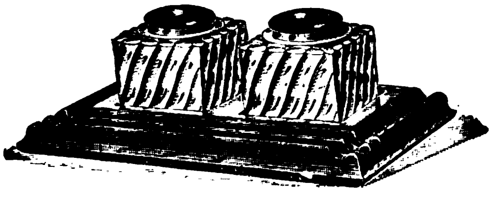

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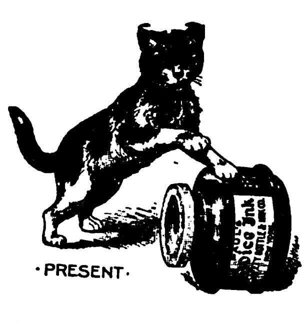

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POPULAR SCIENCE NEWS

Devoted to the Study of Nature and Recent Progress in the Field of Science.

From life by S. A Lottridge.

THE WOODCHUCK

By SILAS A. LOTTRIDGE.

THE Woodchuck is well-known among the farmer folk, for he is as much a part of the farm as the brook or the sugar-bush. There is no animal that uses his means and material to any better advantage, or that has reduced the life of the four-footed to its lowest terms with such success, and takes less trouble and worry in the course of a year, than the self-respecting old woodcuck. To fully comprehend the nature and to thoroughly appreciate the success of this admirable economist, we should acquaint ourselves with his ideals and methods in life.

The woodchuck is born in very humble circumstances. The young members of the family usually number four or five, and the date of their birth is not far from the tenth of May. The snug little chamber in which they are born is located some three feet below the ground, and is lined with fine dry grass which was gathered the fall before. As woodchucks are very neighborly, it is desirable that all the young should be born about the same time; for then the education of the whole community may proceed as a unit, and after graduation day, the elder members may once more settle into quiet life. Whether this was learned from the crows or whether the crows adopted the plan from the woodchucks it would be difficult to say, but each have about the same rules concerning the general birthday and education of their young. The education must be specific, and there can be but few electives. Let us select a representative woodchuck family and follow in a general way their career from the time the young first leave their natal chamber until settled in homes of their own.

The family best known to the writer, was the one that lived by the old rail fence just back of the orchard. The mother first made known her presence by uttering a shrill whistle at old Rover and his boy master as they were on their way to the pond one rainy morning in the latter part of May. The dog bounded quickly in the direction from which the sound came and was soon at the entrance of the hole, thrusting in his head and wagging his tail vigorously, and giving vent to short quick yelps, so characteristic of the shepherd dog. The hole gave evidence of constant use, and for a moment the attention of the boy was divided between that of hunting and fishing, but as fishing would probably yield quicker results, the two soon went on their way.

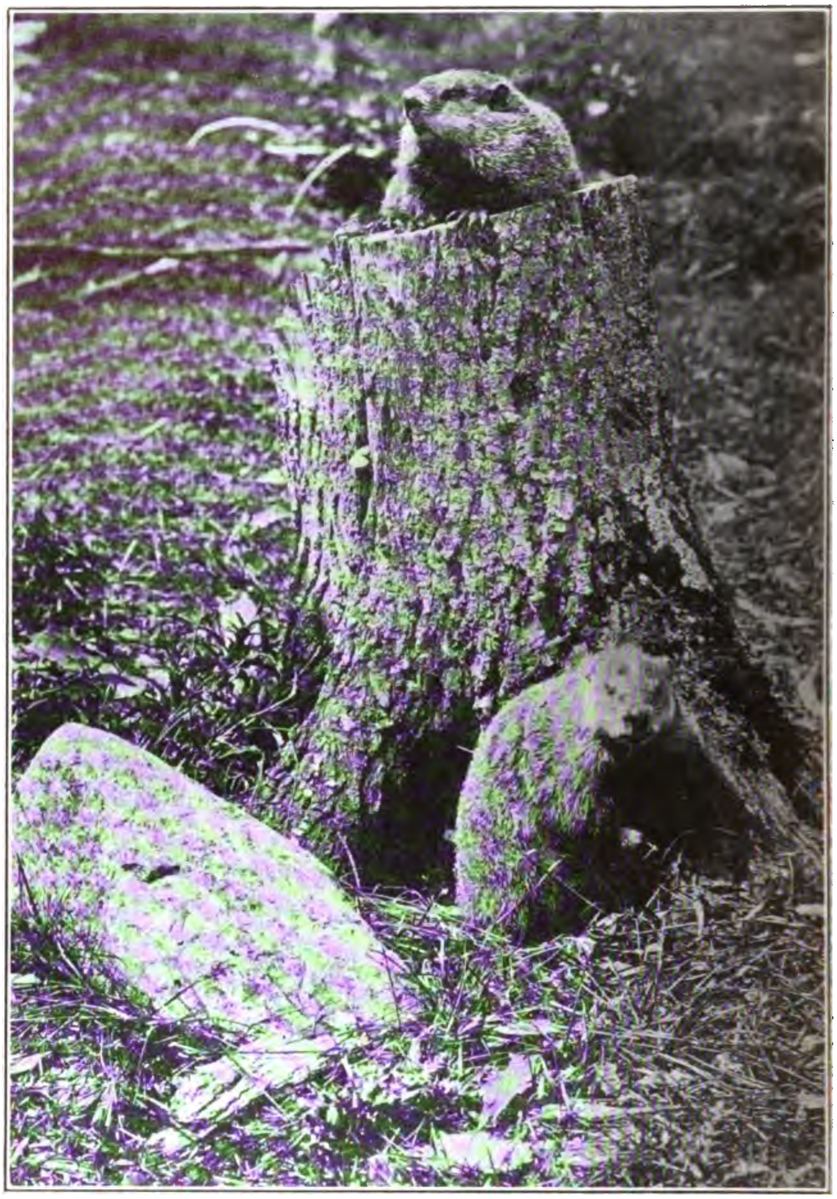
This family consisted of the mother and five little woodchucks. One day the cubs came tumbling along the narrow passage after their mother to the castle-door, and for the first time looked with their large beautiful brown eyes upon the world outside. What a marvellous surprise it must have been to them to view the green grass, the beautiful flowers, and the sky and clouds above! The gentle breeze brought to the dilated nostrils sweet odors from the meadow; a great burst of music saluted their ears, which were now open for the first time, since there was no danger from dust; the wren was singing from the old apple tree nearby. Swinging from the elm bough the bobolink was pouring forth his morning praises, and murmuring insect music filled the air.

The attention of the mother was arrested at every unusual sound, and she did not venture from the entrance until a thorough survey of the surroundings had been made. When satisfied there was no danger lurking in the immediate vicinity, she lead the way into the grass followed by the cubs, which came tumbling after in their haste to keep close to their mother. They tried to imitate her in everything, and when she nibbled a clover leaf, they followed her example, and soon the sharp little teeth were cutting the juicy leaves—they had learned to eat.

It was now time for their serious education to begin. There were all the different kinds of grass to learn about, some were to be used as food, others as medicine. They studied them for some time and then they played and tumbled about; but the mother did not let them wander far from the entrance to the hole, for there were always foes skulking about. The trained ear of the mother caught the sound of something approaching, and she hustled the little ones into the burrow, for old Rover was racing across the meadow, and might turn their way or wind them if he came close. They were scarcely safe when the dog appeared over a knoll in full sight and making straight for them; and they had traversed but a short part of the tunnel before they heard the deep breathing of the dog at the mouth of the hole. The exertion and excitement made their little hearts beat fast, and for the first time in their lives they were frightened—and they needed a lesson but once.

From this time on their education progressed rapidly, and soon they could tell the clover from the plantain, and distinguish among the many sounds that came to their ears, those that threatened from those that meant no harm. Day by day they developed in size, grace and accomplishments, and many were the lessons given on practical mining, tunnelling, and general engineering. They were taught that the dog was not a very dangerous foe, for his presence in the vicinity was usually made known while he was some distance away, but that great care must be exercised if a fox was discovered in the neighborhood. There were occasional lectures upon the mechanics of traps and deadfalls, and some attention was given to the art of fence and tree climbing; for, from these elevated positions they could command a much more extended view of meadow and woodland.

While the woodchucks do not live in towns like the prairie dogs, still the neighbors are not far distant, and as soon as the younger members of the families are old enough, they begin playing together. Our little family had thrived until now they were more than three-quarters grown, but they thought themselves as large as most woodchucks. The time is fast approaching when they will settle down to the serious business of life, and almost the first thing they will do, will be to fall in love. This is the most natural thing that could happen, for, after playing together through childhood and youth, this affection should ripen into courtship and marriage. It would be most interesting if we could follow all the secrets of this rustic courtship. It probably began by the swain taking her part in play against some larger playfellow and almost before he knew it, he had invited his lady friend to enjoy the most choice of young clover and plantain down by the orchard, or he had gallantly defended her against the fierce attack of some wandering dog. Their rambles became more frequent, and before long they were stealing across the meadow in the moonlight, nibbling here and there some choice tidbit, and only hurrying home as the moon warned them of the lateness of the hour. Soon life began in earnest for this pair of woodchucks.



From life by S. A. Lottridge. WOODCHUCKS AT PLAY.

Trying to remember all they had been taught, and ever mindful of the parting advice of the parents, they selected a gentle slope close by the meadow and began the construction of their home. The husband of the family now proceeds to dig with a will and rapid work he makes of it, for his feet are armed with powerful claws and there is a partial web between the toes, forming a combined pick and shovel. The fore feet being used principally for digging and the hind ones for throwing backward the loosened earth and stones.

For some distance from the entrance the hole slants downward quite sharply, and then turns slightly upward and continues along beneath the surface for a distance of about thirty feet. This arrangement secures good drainage, which is so important in the woodchuck home. There may be one or more side tunnels from six to ten feet in length. One of these may end in an exit, usually very small, and may be in a tuft of grass. There is no refuse about it to attract the attention of an enemy. The main burrow ends in a chamber of considerable size, for the convenience of the family, and is lined with fine dry grass.

When this work was completed the woodchucks were ready for housekeeping. The meadows have been mowed and a new crop of clover is spread before them, and there is nothing to do but to eat and doze about in the sun. With five weeks of this sort of life there is a marked change. The cheeks of the woodchucks were so large and distended that you would have believed it was caused by a well developed case of mumps. The ribs were widened, the loose skin had grown sleek, and stretched with fatness.

September is well advanced and the woodchucks could hold no more and had only to wait and doze away the time until their Lenten season, which began about the first week of October. The blood had already commenced to run more slowly through their veins, and a sleep was gradually stealing over them which they could not resist, and they curled themselves side by side into balls of fur in their snug retreat—and fell asleep.

From life by S. A. Lottridge.

A YOUNG WOODCHUCK DIGGING A HOLE.

Beautiful October days followed and nature seemed to smile under the mellow light, but the slumber of the woodchucks was unbroken, and thus the winter passed in one long dream of summer. This plan of the woodchuck's life is not quite perfect, for his waking occurs in the latter part of March, which seems a little early. He comes forth from his burrow, and like the bear—if he sees his shadow he returns to his bed to sleep for another forty days.

Paraffine Wax to Mend Trees.

A new and important use for refined paraffine wax has been discovered by a prominent resident of Ohio, living near Lancaster, who had two trees badly damaged by storm, one being a maple and the other an apple. In each case a large limb was broken down from the trunk, but still attached to it. The limbs were propped up and fastened securely with straps, very much as a broken leg might be fastened with splints, and then melted refined wax poured into and over all the cracks. The surgical operation was entirely successful. The paraffine prevented the escape of the sap, kept out the rain and moisture which would have rotted the trees, prevented the depredations of insects, and the limbs seem to be reattached to the trees.

Animal Life

THE BOBOLINK.

BY M. G. JENISON.

The bobolink, as he is called in the north, the reed bird of the middle states; the ortolan and rice bird, or rice bunting, of the far south; the butterbird of Jamaica, and in ornithology, Dolichonyx oryzivorus, is migatory over the entire North American continent, from the Atlantic to the great plains of the west, as far north as Labrador. From their winter home near the tropics, chiefly on the western islands, they appear on the California coast in April and May, whence they continue their journey northward, destroying some of the growing rice as they go

After passing about the 40° N. Lat., they are known and welcomed as the familiar bobolink, and especially through New England, probably none of our wild birds are so surrounded with romance, as Robert of Lincoln. Their arrival at the north appears to put them all on their best behavior, and from regions where they are known chiefly as crop destroyers and where they are heartily despised, except when cooked, they come to a region where they are cordially welcomed, and at a time when they give little or no cause for condemnation.

The male usually arrives at his destination a few days in advance of the female, and on the coming of the latter, love-making and domestic life quickly follows. Their nest, which is constructed of dry grass, is found in some slight depression in the ground in the open meadow, and in it are deposited four or five eggs of a brownish clay color, with spots and blotches of different shades of umber.

All during the period of incubation the male continues the same loving companion that he had been since meeting his mate, devoting all his spare moments to singing; but when his children arrive and gradually reach maturity, his whole character changes. His singing ceases entirely, and, in place of the jolly rollicking song, there is heard only an occasional chirp. He also changes his attractive spring suit, which may be described in detail as follows: The upper part of the head, shoulders, wings, tail, and the whole of the under plumage, black; lower part of the back, bluish black, which in the female, young male and adult, after the month of June, is pale flesh color; the feathers of the tail formed like a woodpecker's; legs, brown. The female, whose plumage the adult male assumes after the breeding season, has the back streaked with brownish black, the whole lower parts of a dull yellow. The young birds have the dress of the female.

After the young are able to care for themselves, and the meadows are deserted, the birds lead a comparatively quiet and secluded life during the remainder of their northern stay, favoring the wild rice marshes when accessible. During the early summer their diet is largely insectivorous, the young being fed almost exclusively on such food. A considerable quantity of seed of various weeds are eaten, and although they probably do take a small quantity of grain, it amounts to but little, so that during their northern life the bobolinks may be considered far more beneficial than injurious to the interests of agriculture.

In the autumn, when they appear in the reedy marshes of Pennsylvania, Maryland, and the adjacent regions, they are known as reed birds, and are much sought after by the sportsmen. As they continue their migration they appear in the rice districts of the south as the rice bird, or rice bunting, and here it is that the greatest amount of damage is caused by them. The annual loss from their visitations is estimated at about two million dollars,—a part of which, however, is for the cost of men or boys and guns for the purpose of destroying the birds, or frightening them away. But all efforts appear unavailing, for it is impractical and almost impossible to exterminate them, and nothing appears to answer the purpose.

If it were not for the rice fields being directly in the tract of the migration of the bobolink, the probability is that there would be little or no loss from this source. But as it is, the birds, in their fall journey, arrive in this region when the grain is ready for harvest, and it is little to be wondered that they take part in the harvesting, or that they prolong their stay, growing fat, sluggish, and apparently indifferent to consequences. After a few weeks, or in the latter part of September, they continue their travel, after they have cleared some of the rice fields so thoroughly that but little remains for the owners. We next hear of them in Jamaica, where, from feeding on the seed of the sorgham, they become so fat that they are known as the butterbirds. Having arrived at their winter home, there they remain, waiting for the spring to come again.

SOME INTERESTING REPTILES.

BY F. G. SPECK, JR.

The student of natural history, who has given little or no attention to reptiles, will be interested in a detailed description and classification of some of the remarkable forms.

The curious Horned Sand Toad (Phrynosoma coronata) of the southwestern United States, especially California, varies in length from 3½ to 6 inches. In this genus the body is flat and has the appearance of a frog. This odd species is sluggish and yet possesses considerable activity, being able to bury itself in soft sand with remarkable celerity. It is cautious but quick to apprehend; the food consists of all sorts of insects, the tongue being used to some extent in the capture of small insects and to lap up water. Water, however, is not a necessary adjunct to the existence of this lizard.

The distinguishing feature, however, is the peculiar formation on the occiput. Four prominent horns extend directly out from the skull, giving the reptile a very ferocious appearance. The whole back and sides are covered with more or less sharp-pointed scales. The tail is short. The scales on the back are granulated and those on the belly are hexagonal and overlapping. The scales on the head are small and not symmetrically arranged.

On the back are transvere bands of dark brown on a light gray or brown background. Behind the head, on either side, is a black blotch. The belly is covered with small black spots, the background being white. The color is also somewhat changeable, which is characteristic of this whole family. The scales under the chin are symmetrical, and the throat fold is also prominent. The tongue is non-prehensile. This species is oviparous; the number of eggs is about five.

It belongs to the class, Reptilia; order, Sauridæ; series, Pachyglossa; tribe, Strobilosaura; family, Iguanidæ; sub family, Phrynosominæ.

The Green Lizard (Anolis principalis) of the southern states, is in length 6 to 8 inches. This is an arboreal lizard, spending most of its time among the trees and bushes, and effecting such rapid changes in color that it is quite difficult to distinguish it when resting in the branches. The scales are granulated and of the same nature all over the body. However, those on the tail are whorled, as in all of the lizards of the family Iguanidæ. The scales of the head are non-symmetrical.

The color varies from the brightest green to the dark brown, and thus through the intermediate shades, including the spotted variations. The feet are arranged to accord to the arboreal instincts, having the antepenultimate joints striated crosswise. Its food comprises almost all soft insects, having a preference for flies. During the summer the skin is regularly shed in every few weeks, the process is aided by the mouth and feet. In the night the color is invariably green. One of the most remarkable features is the scarlet dewlap in the throat, which, when angry, the creature distends till it hangs down vertically. When thus, this lizard presents one of the most beautiful phases of anger imaginable. The tail is very long, and quite fragile. When broken off, this member is not replaced, as in the case of a number of species. The body is slender, but very graceful. The throat fold is absent. In this species the tongue is also used to draw the food into the mouth, and to drink, but it is not prehensile. The young are hatched from eggs.

It is of the same order, series, tribe and family as the Horned Toad, but it is of the sub family Anolinæ.

The Green Lizard (Lacterta viridis) of Southern Europe, especially Italy, is 10 inches long. In this species the color is a bright green, shading to yellow on the under side. The form is very well proportioned, and suited to a life spent in both trees and on the ground. The toes are prolonged and tipped with sharp nails, which enable the animal to proceed with exceptional rapidity over the ground. The scales on the back are small and closely set, while those on the belly are transversally broad, and extend from side to side. The throat fold is well defined. The scales of the tail are arranged in whorls, their form being rhombic. When destroyed, the caudal portion is renewed. This creature is exceedingly susceptible to domestication, and shows something of an attachment for those with whom it is brought into contact. The tongue is used an organ of touch, also to lap up water as a dog would. Its food consists of insects, particularly of larvæ. The members of this genus are oviparous. The cranial plates are symmetrical, also those of the chin.

This saurian is of the series, Leptoglossa; tribe, Cyclosaura; and family, Lacertidæ.

The Blue-tailed Lizard (Eumeces fasciatus) of the southern United States, attains a length of 10 inches. The formation of this lizard is suited to a thoroughly terrestrial existence. The body is stout and cylindrical, and covered with flat, smooth scales, which overlap each other. Those on the tail and belly are the same as those on the back. All its movements are very rapid; on the whole the creature is the embodiment of hidden springs. Also the species is rather aggressive, and with its sharp teeth can inflict a painful bite. The head is rather flat, and a lobe extends out behind the ears. The throat fold is absent, and the scales of the head are symmetrical.

The color above is a brown or black with fine longitudinal stripes of white, the top of the head being light brown. But the characteristic color is the beautiful blue of the tail; in some specimens this blue is dull, but in others it is most irridescent. Its food consists of insects. The tail is quite fragile, in this respect resembling the other members of the family Scincidæ. The tongue is prehensile and flesh color. The color beneath is a light drab.

The classification is: series, Leptoglossa; tribe, Geissosaura; family, Scincidæ.

The Blind Worm (Anguis fragilis) of Europe, has a length of 12 to 18 inches. Minus limbs, this queer lizard looks more like a snake than a lizard. The body is long and cylindrical, the tail occupying about one-half the total length. Progression is slow in this species, as the gastrostegal plates are not arranged as in the ophidians, but are the same as the scales on the back and sides. Throat fold is absent. The head is small, also the eyes; the tongue is black, and very much like that of a snake, although not so pointed. Above, it is a bronze brown, which forms a broad dorsal stripe; this gives place to lateral color more of a reddish-brown, and underneath it is black. The Blindworm is quite fond of slugs, earthworms, etc. The species name is derived from the extreme fragility of the caudal region. The young are hatched from eggs and are lighter in color than the adult; the portion that is bronze in the adult is white in the young, and this is divided down the center by a narrow black line.

It is of the order, Saurians; series, Leptoglossa; tribe, Geissosaura, and family, Scincidæ.

Salt for Sheep.

The Agricultural Journal of the Cape of Good Hope contains a note upon some French experiments which have been made respecting the use of salt in the dietary of sheep. Three lots of sheep were fed identically, excepting that one lot had no salt, another lot had ½ oz. every day and the remainder ¾ oz. daily. Those receiving ½ oz. gained 4·5 lb. each more than those which had no salt and 1·25 lb. more than those which had more than ½ oz. The salted sheep had 1·75 lb. more wool and a better fleece than those which had no salt.

Vitality of Germs.

Research by Prof. Macfayden, just concluded, has shown that many varieties of micro-organisms can be exposed to the temperature of liquid air for a period of six months without any appreciable loss of vitality, although at such a temperature the ordinary chemical processes of the cell must cease.

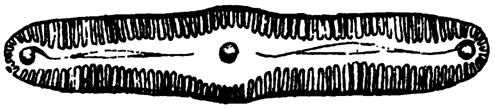
Plant Life

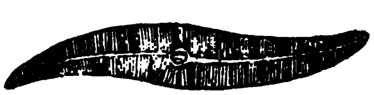
DIATOMS.

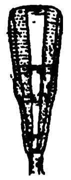
BY F. R. MILLER.

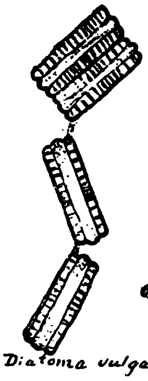
Among the microscopic inhabitants of marine and fresh water, none are probably more common or remarkable than the curious little organisms called Diatoms.

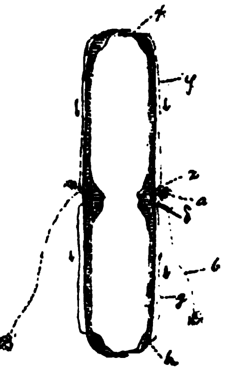
In order to obtain a supply for study, we should make an excursion to some pond or small stream, the surface of which is covered with the common algæ or green scum. Some of the latter should be placed in a bottle, and on our return home, a small quantity teased out on a microscope slide by means of a pair of needles. With a fairly high power we shall probably see between the meshes of the green plant, curious little light brown or yellow bodies which flit this way and that, now stopping suddenly, now starting forward again with accelerated speed, like so many miniature ferryboats.

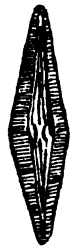

Pinnularia


Pleurosigma


Gomphonema


Diatoma vulgare




Navicula

Encyonema

Synedra

If we examine a Diatom at rest we shall see that it consists of a shell, or so-called frustule, composed of very hard siliceous material. This shell or frustule is in the form of two valves, one of which fits over the other, thus producing a small structure not unlike a pill box. This is why a Diatom looks different, depending on whether a front or a side view is obtained. Each valve is beautifully sculptured with radiating lines and small dots, and some species are so delicately lined that they are used as test objects for first-class microscopes, which are guaranteed to bring out the markings when a certain power is used. Inside the hard, siliceous shell, and adequately protected by it from the dangers of the outside world, is the protoplasm, or real living portion of the Diatom. Chlorophyll, the coloring matter present in all green plants, occurs in the protoplasm—and thus proves Diatoms, in spite of their motility, to be plants. The green color of the chlorophyll is, however, masked in this case by means of diatomin, which imparts the yellow color.

Probably the most curious feature about diatoms, as plants, is their unusual power of motion; in order to understand something about this mysterious movement, let us refer to the lettered figure, which represents one of the common motile forms. A stream of protoplasm *y*, passes out of a small cleft in the frustule at *x*, and then on backwards to another opening at *s*. During its course the stream absorbs tiny granules, which are subsequently cast out at *a*, and then give rise to the thread *b*. Another similar stream starts out from a cleft at *d*, and passes backwards to an opening at *h*. The majority of diatoms are motile; some few, however, like Gomphonema, are attached at one end. The shape varies enormously —it may be circular, S-shaped, as in Pleurosigma, needle-like, as in Synedra, or in the form of zig-zag chains as in Diatoma vulgare.

The classification of diatoms is mainly based on the shape and markings of the frustule. For exact taxonomic determinations it is therefore necessary to remove all the organic matter. This is accomplished most readily by treatment with boiling nitric acid, after which it is necessary to wash with distilled water and then mount dry, or in balsam. A series of slides prepared in the above manner will furnish endless entertainment to anyone possessing a good microscope, and although the number of diatoms is so enormous that the average amateur can only expect to know comparatively few, nevertheless they are so beautiful and varied in form that time spent in examining them is amply rewarded. I have given illustrations of those which one can scarcely fail to meet with, whenever he is looking through fresh-water material collected for microscopic study.

FASCIATION.

BY MRS. JOHN M. MILLAR.

A few autumns ago I saw a curious specimen of fasciation among harebells. The plant was about two feet tall, the lower stem leaves were narrowly linear. The main stem was flattened instead of being round. About nine inches from the ground the stem separated into two branches, and on the tips of these branches were tufts of leaves, some of which were lance-shaped, half an inch long; others spatulate and toothed, and still others thread-like. The tiny thread-like leaves were scattered along the stem that grew from one side of the tufted branch, and bore the blossoms. The blossoms were beautiful and more singular than any I had ever seen. They were larger than St. Dominic's flower usually grows, and were of a delicate blue.

What rendered the plant unique, and with its general appearance caused me to think at a first superficial view, that we were so fortunate as to have discovered a new variety of Campanula rotundifolia, was the fact that in the center of the flowers were two perfectly-formed petals—the bluebell of Scotland, with variations!

Botanists tell us that this change from the natural to the abnormal has been observed in many woody and herbaceous plants, and that it is produced by the growing together of the buds in the earliest stage of their growth. Prof. Bailey writes in the American Botanist of having seen the phenomenon of fasciation exhibited in "the bulbous and tall buttercups, in the white-weed, and in the cone flower, or Rudbeckia, in both the native and introduced Linarias, like the butter-and-eggs, and in the asparagus." It is perpetuated in the fantastic form of the brilliant garden cockscomb. Maxwell Masters' catalogue of 150 plants which exhibit fasciation, is an entertaining and instructive study for one interested in nature's varying moods.

SOMETHING ABOUT POISON IVY.

BY JOSEPH A. CUSHMAN.

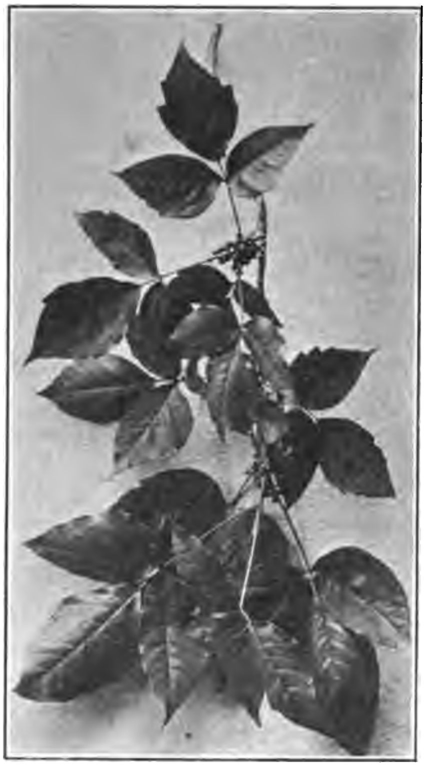
So frequently do we hear of people being poisoned by this plant, that there can be but one explanation; it is not even yet sufficiently known. Attention has been called to it so often that it would seem as though it might be given a wide berth, especially after one "personal acquaintance" with it. I recall the case of a teacher who collected some bright red leaves on a Saturday afternoon in the fall to use in her work in nature study the following Monday. The plant proved to be poison ivy, and it is perhaps unnecessary to add that the proposed lesson was given up. If the ivy had been collected Monday morning and placed in the hands of the children before it had proved its identity to the teacher, we can imagine what might have happened. Cases may turn out to be quite serious, besides the pain and decided inconvenience for a time.

What are some of the marks by which this plant may be distinguished, and being recognized, let alone? Some say beware of vines with three leaflets. This would avoid all trouble, but would place under the same ban our Virginia Bower and Hog-Peanut, two of our most charming vines, despite the common name of the latter. But certain marks may be given which will distinguish, and once it is really known little trouble will result. Its leaf first of all—of three leaflets, as in the accompanying illustration, its surface very smooth, and with a fresh green color. In June it has small greenish-yellow blossoms, and in the fall grayish berries which are often picked for their decorative appearance by those who do not know the plant.

The vine climbs by roots from the main stem, and presents a matted, hairy appearance in old growths of the plant. In states where the winters are severe, woody growth is prevented, and it becomes a trailing vine. In most places it is a climbing vine, hiding stone walls and fences, and especially liking the trunks of oak trees. When it assumes climbing form it can be easily recognized by the character mentioned above.

There is also some difference in the leaves; in plants running on the ground the leaves are apt to be more cut and notched, while those clinging to trees and developing much woody tissue are more nearly entire in outline. In Autumn they turn yellowish red. One of the peculiar things about this plant is its varying effect upon different persons. Some are poisoned by going near it, even, if as they claim, they do not touch it, while the slightest touch is enough to cause some persons misery for a time. Others seem to be immune to its effects. I remember some years ago, one boy, who to gain the admiration of the rest, would calmly chew the leaves, always taking care I have noticed, not to swallow them.

The ivy may be easily distinguished from our Virgin's Bower or Wild Clematis. The latter is a vine climbing over walls, fences, bushes, etc., but not climbing the trunks of trees or developing much woody tissue. It has three leaflets, considerably toothed, and twists the petioles of leaves about the twigs and branches of other plants in climbing. This plant does not flower until midsummer, and its flowers are more attractive than the plant itself. They are white and in fairly large clusters. In the fall when the leaves turn, the Clematis has its seeds with long grayish plumes which are very noticeable.



POISON IVY.

In the fall the ivy may be mistaken for our Woodbine or Virginia Creeper, but the number of leaflets in the latter plant is five. Then a comparison of the shapes of the leaflets of the two shows a marked difference.

The best thing to relieve the intense pain caused by poisoning is to apply cloths wet with Hamamelis. The poison of the ivy is due to an oily fluid which spreads over the skin and causes the irritation. F. Schuyler Matthews speaks in one of his books of seeing the ivy growing in close proximity to the Witch Hazel, from which hamamelis is manufactured. Thus the poison and one of its antidotes were neighbors.

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How the Holly Protects Itself.

To effectively appreciate the protective element of the holly it must be seen in its wild state, where its foliage grows thick and bushy down to the ground, its dense masses of strong and prickly leaves protecting its stem and bark; and it should be observed that almost invariably it grows alone—in fact, for some distance round about it very little vegetation of consequence is seen, unless it is large trees. Why is this? The closely packed, opaque, and coriaceous leaves of the holly prevent the sunlight reaching the ground, and so the seeds have little or no opportunity of germinating, or of growing afterwards if they should. And even climbing plants seldom select the holly as their host, and those that do are usually plants that have made a mistake in life, because the tender green leaves and stems with strong winds and rain get jostled and lacerated on the innumerable prickles amongst which they have become hopelessly involved, as the holly and their own branches have developed. And being an evergreen—always on the alert—it gives no other enterprising plant an opportunity of ingress; producing, too, its tender green leaves at a time when there is abundant food for browsing animals; and at the same time these are exceedingly bitter in flavor.—Harper's Magazine.

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Fruit and Cold Storage.

The eccentricities of the behavior of fruit in cold storage warehouses are to be investigated by the Department of Agriculture. It is often noticed that while one lot of fruit is perfectly preserved and retains its flavor in cold storage, another, under identically the same conditions, rots or loses flavor in a few days. A number of shipments of fruit from different localities are each to be watched during packing, shipping, and in storage by a government agent, in the hope that the accidents which influence the keeping of the fruit may be known.

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Forest Reserves.

The total area of all the forest reserves is now 58,850.925 acres. It is interesting to note that the total area of the United States, exclusive of island possessions, is 2,362,960,000 acres. Thus it will be seen that the forest reserves now amount to about one-fortieth of the entire area of the United States. In square miles the area of the reserves is 91 954, or almost twice the size of Pennsylvania.

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Mountains Affect Sea-Level.

In a paper at the last British Assoc. meeting, it was affirmed that the attraction of mountains and continents produced permanent elevations on the surface of water, just as the moon produced the tides. The surface of the sea did not therefore coincide with the surface of the mean figure of the earth, but suffered from deformations and disfigurements. The deformed surface of the figure of the sea was called the level surface, because all geographical heights had to be referred to it; but it might differ considerably from the mean surface of the earth, being separated by an unknown amount.

Archaeology

Edited by WARREN K. MOOREHEAD, M. A.

ROCKFORD MOUNDS.

BY CLARA G. SANFORD.

In the midst of the city of Rockford, Illinois,—a place of over 31,000 inhabitants—and within four blocks of the heart of the city, has been preserved a group of Indian mounds. Fourteen of them are still to be seen, many in a nearly perfect state of preservation; although detrition has worn down the elevations and filled up the surrounding land, making the height of the mounds much less than when first built.

LOOKING SOUTH, OVER NO. I, TOWARD END OF DRIVE. NOS. 4 AND 2 SHOWING IN CENTER AND AT LEFT OF PICTURE. TURTLE MOUND AT RIGHT, BUT HIDDEN BY FOLIAGE.

These mounds have been the source of much interest and speculation to local students of aboriginal history. For twenty years or more I have studied their shapes and location, and supposed I had absorbed all that was possible of their meaning; but one raw January day, I happened to read the statement that a careful measurement and drawing of mounds, accurately reduced to inches, would reveal shapes not discernable in the grassy and enlarged outlines; seizing a tapeline and paper pad, out I went into the stinging wind, too eager to discover any hidden record of a vanishing race, to wait for a more temperate day.

I was well rewarded for my pains. My hastily impressed assistant soon pronounced the weather too bitter for field work, and retired from service, but I continued my measurements and drawings single-handed, and as Night began to drop her curtain, my roughly sketched map showed, that of which I had never dreamed before—an Indian game-drive!

As was their habit in building mounds, the Indians, in this case, chose one of the most beautiful spots on the bank of Rock river. The village probably lay to the southwest of the drive. Not only does the location of the mounds indicate this, but it is a well-known fact the white city and the Indian village have always occupied the same site. The big, turtle mound that served as a screen for the hunters, a lookout for enemies coming by way of the river, a tutelar divinity (these effigies were a part of their nature worship) and perhaps as a totem, stood also for a defense between the close-by village and an approaching enemy.

Nature has helped the builders in the construction of their game-drive. The river on one side of the drive, and a gully, which was the natural watershed of this location at that time, (it is now nearly obliterated) on the other side, cut the land into a long V. On the bank of the river, at the point of the V, was then a spring of cold water. It has since been covered up in filling in the bank. Animals, probably deer and buffalo, in coming to drink, would prefer the cooler water of the spring; so, near the spring, these prehistoric hunters took advantage of a natural rise of land to build a turtle mound.

This mound measures fifty feet from fore foot to fore foot, and is 140 feet long, —the tail being extended to meet the emergencies of the game drive. This mound (1) is the highest one of the group, and here the sentinel stood and watched for the appearance of game. When the game was sighted, he slipped into a semicircular pit or excavation in the bank, just between the turtle mound and the spring.

No. 2 is a fortification mound 156 feet long and 18 feet wide, that lies nearer the river, and forms the eastern side to the end of the game drive, of which the pit has full command. Two platforms of earth are still traceable on the side of the pit, where the hunters could stand and watch the game as it entered the drive, and then, when it drew nearer, step to lower ground; for the Indians, having only bows and arrows in place of guns,

LOOKING SOUTH, THROUGH END OF DRIVE, TOWARD PIT. NO. II AT LEFT, IN FOREGROUND. NO. 2 BEYOND IT, NEAR THE RIVER. NO. 3 AT RIGHT HAND SIDE. TURTLE MOUND IS HIDDEN BY SHRUB AND BY NO. 3.

LOOKING NORTH, THROUGH UPPER PART OF DRIVE. MOUNDS 3, 11 AND 10 APPEARING NEARLY LIKE ONE MOUND

needed to have the game come near enough to have arrows take effect. By looking at the map, it will be seen that if the game turned to flee, the large circular mound (No. 11) standing as it does at the opening intervening between the turtle and the fortification mounds, apparently stopped the way, and thus hindered their escape.

As shown by the map, one line of mounds runs along the river bank, and another on the opposite side of the drive. Most of these mounds are circular; two are rather small, one is large and very perfect, and four are somewhat smaller in size. There is also a bird mound with one wing gone, and an oblong mound. There are three more mounds, lying north of these, not shown in the plate, that belong to this group. One of these I take to be another bird mound, probably a water bird, and like the other bird mound, the wing on the west side is missing. As weapons are the only effigies with one projection on one side, shown in Indian earthworks, I have tried to see in these, stone axes, but the head of the bird is visible, and all the other outlines, save the one wing. I am convinced that No. 5, at least, is a bird, and in conformity with Indian ideas,—for these effigies were supposed to help them in hunting—was intended, together with the bird not indicated on the map, to direct the game toward the spring, and into the hands of the hunter.

To the east and north of the drive the land rises in a beautiful slope and helps in the perfect formation of the game-drive. Standing on the platform in the pit, and looking up the length of the drive, it is easy to slip backward 90 years, and to see, in imagination, shaggy buffaloes rolling heavily in between the mounds, and more timid deer with their spotted fawns, bounding gracefully over the turf, all silently urged, by the skillfully placed mounds, into the fateful drive.

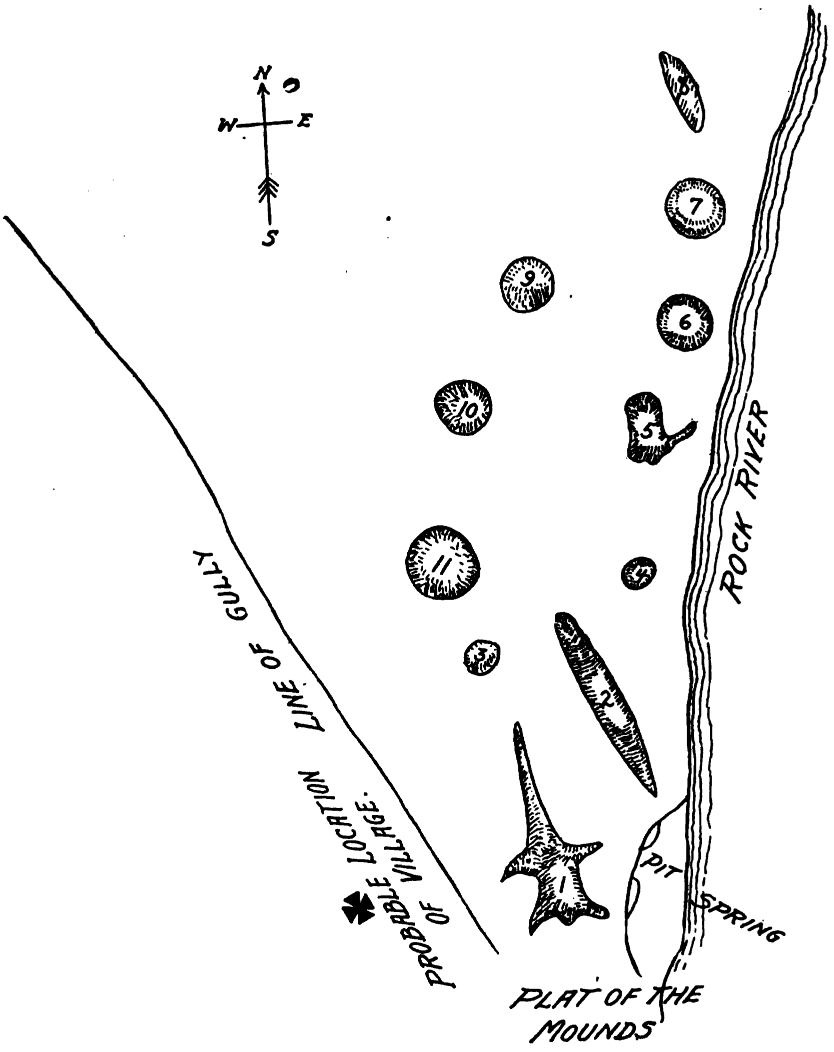
It is probable that the clans along the Rock were Turtles, as the turtle effigies appear in and near Beloit, Wisconsin, some 18 miles north of Rockford; yet a turtle effigy, on the banks of a river where turtles abound, is in keeping with Indian custom to make mounds like the surrounding birds and animals; water birds and animals beside the water; forest birds and animals in the forest; and prairie birds and animals on the prairies. Neither would these mounds lose their significance as totems and divinities; for the same propinquity of animals and birds that led the Indians to imitate them in earthworks would also influence the Indians to choose them for their divinities and their respective totems.

There is still another meaning, I think, in this grouping of mounds. If the village lay to the southwest, this drive served as an admirable defense to the village. The enemy that would approach with most rapidity would be the one that came with the stream, and not against the flow. The long mounds are all placed to face upstream; therefore a large body of warriors could lie concealed behind them, while they waited the approach of the hostile canoes, and be in the best possible position to make an attack. Then, too, the inner row of mounds is so placed that they cover the spaces between the river mounds.

The high turtle mound (1), and the big circular mound (11), both command a view far up the river; if an enemy were sighted, a considerable force of warriors could creep up to the front mounds, even to the most northerly ones, without being seen from the river; or they could beat a retreat, if necessary, under cover of the same protecting earthworks.

The usual path, that always lies near Indian mounds, is still to be traced, in spots, where the bank has not been molested.

Only one in this group of mounds has ever been opened. Years ago, one of the circular ones (7), in which relics might be looked for, was cut through, but the person doing it was not experienced in mound exploration, so the fact that nothing was found is not conclusive proof that nothing was there. When the land was purchased, more than fifty years ago, these mounds were covered by hazel brush. Since then a grove of oak trees has sprung up, and fear of killing the trees, or injuring the shape of the mounds, has prevented the owners from making further investigations as to their contents.



The accompanying map does not have the exactness of a surveyor's plate, yet it is sufficiently accurate to show the relative size and position of the mounds, and their skillful grouping to entrap game, and to defend the village.

Telephone Vibrations.

The vibration of the diaphragm of a telephone receiver is not easily measured, but the best calculation is said to show a movement of about one twenty-millionth of an inch.

TORTURE AMONG AMERICAN TRIBES

BY WARREN K. MOOREHEAD.

This is a gruesome subject at best, yet it must be considered if one would study our aborigines. Whether the natives practiced torture prior to the Discovery, to the extent that they did after their acquaintance with the gentle and humane (?) Spanish and French, is a disputed point. To-day, the Indian is better understood, and, while we may not excuse his cruelties, yet we can appreciate what inspired them.

The passing of the wild tribes and the consequent abandonment of western frontier military posts, brings to mind the "good old buffalo days" when adventurers flocked to the plains to find excitement—and found it. The American aborigines' side of our little frontier wars has never been told; or at least but superficially. I once heard a man, who was familiar with Indian affairs, say that for every murder, raid or attack committed by Indians on whites from 1845 up to 1885, he could cite at least three instances of unprovoked murders, thefts, or raids of whites against the Indians. If any person doubts the statement let him investigate the subject—for there is no lack of printed proof. Even if this fail to convince him, let him ponder upon the following striking fact:

During years of close contact with both friendly and "hostile" tribes, the Quakers in the East, the Canadians in the North, and the Mormons in the West, have had no trouble. We may differ from the Mormons and have no faith in their religion, but that they knew better how to treat the "savages," no fair-minded man can deny. It must also be remembered that they had no strong government back of them to furnish troops; they were near no populous centers. On the contrary, at the time of the Salt Lake settlement, they were more than 1,200 miles (excluding Mexican villages to the south) from civilization, and their country could only be reached by a long and perilous overland journey across plains infested with hostile tribes and sub-tribes.

The torture of captives has been the black spot on Indian character. I do not attempt to explain it away, but I do hold that what was originally a native rite, a ceremonial enacted only upon certain occasions, became a general practice through external influences. Let us examine the matter somewhat carefully.

The Sioux of the northern plains, the Comanches of the southern plains, the Apaches of the Arizona-New Mexico (and western Texas, northern Mexico, etc.) region were noted for their cruelty towards captives. Up to the time of our revolution the Iroquois were considered the most cruel of eastern Indians. These powerful tribes were, doubtless, more bloodthirsty than the other and numerous bands of natives surrounding them. The Iroquois suffered severely at the hands of French, Dutch and English colonists. Yet there is a little to be said in extenuation of their conduct. With the western tribes it is different. The Apaches were either hung, burned, or sold as slaves, and their towns destroyed by the early Spaniards. Consequently the Apaches became the scourge of the southwest. The Gulf tribes first felt the iron hand of Spain. Then came the Texas Rangers carrying death and destruction alike into the camps of friendly and hostile Indians. As a result the Comanches became famous raiders; they excelled as horse-theives, but their cheif delight was to secure the person of a Texas Ranger and torture him to death.

The Sioux and their allies formed the strongest tribe west of the Mississippi. In some forty important engagements with national, territorial or state forces, they were victorious twelve times, suffered defeat on seventeen occasions, and eleven times managed to withdraw with slight loss to themselves. The Sioux came in contact with the worst elements of civilization. From the Black Hills to the frontiers of Texas the board-and-canvas cities were filled with gamblers, bad men, buffalo hunters, outlaws and the off-scourings of the East. These men cared not for the rights of others. Of the miners and trappers so numerous in the foot hills, some were quiet and peaceable, while others held all Indians to be hostile. Certain parties of emigrants crossing the plains fired upon any Indians met. Instances are not wanting where strychnine was put in whiskey and the keg left in a camp as if it had been overlooked. On one occasion nineteen Indians were thus poisoned. Villages have been attacked by whites and the women and children shot down while endeavoring to escape. Horse-stealing, frauds, the issue of poor rations, etc., and other outrages common on the plains in the sixties and seventies were instrumental in convincing the Sioux, as chief Red Cloud said, "that all white men were rascals."

Col. Richard Dodge was for thirty-three years engaged in active operations against the Indians. His book, "Our Wild Indians," is now out of print. Dodge presents some remarkable instances of Apache and Comanche cruelty, and as readers of this journal may never have heard of them, I quote from his work at some length:

"In 1868 an attack was made by a party of Indians on a station of the Kansas Pacific Railroad. The men who were on herd were made prisoners almost without resistance. The other two or three successfully defended their position, to the great exasperation of the red-skins, who, after losing several men, drew off.

"Just at nightfall they took their prisoners to a position in plain view, but beyond rifle range of the station, stripped them of their clothing, staked them to the ground, built a fire on the breast of each, and while some sat near warming themselves with great apparent satisfaction, the others indulged in a dance of rejoicing. The cries and groans of the unfortunate men could be plainly heard by their friends, but nothing could be done, and it was not until far into the night that the cessation of complaint proved that life was extinct. Next morning the Indians were gone, but the blackened and half-burned bodies were found still fastened to the ground, not only scalped but terribly mutilated, and one, being an unusually hairy man, almost skinned.

"Of all the Indians, the Apaches have deservedly the credit of being the most ingeniously and relentlessly cruel. While yet a dependency of Spain, the present Mexican state of Chihuahua was well peopled. Thriving settlements and prosperous ranches occupied every stream and spring, and the whole country was covered with cattle. While the Spanish power was dominant, the Apaches appear to have given little trouble, but taking advantage of the disturbances consequent on the revolution of 1824, they commenced upon the unfortunate state a series of depredations, so disastrous, that in population and wealth, it is now scarce 'the shadow of its former self.'

"They destroyed property, killed cattle, carried off the women, killed and tortured the men from pure love of deviltry. One of their favorite tortures was to strip their unfortunate captive and bind him tightly to a huge cactus.

"To this day they are regarded as a fate to which everything is referable, and a common saying in regard to a bright boy is: 'he will make a fine man if the Apaches do not tie him to a cactus.'

"Of all the horrible stories which I have heard of Indian cruelty, one told me by old Espinosa is most vivid in its ghastly horror. Espinosa was the most famous trailer and scout of the southwest. A Mexican, he was early captured by the Apaches and reared in their villages. He was courageous and rendered our troops many years of faithful service. He was shot while on duty carrying dispatches in Texas at the beginning of the Civil War. He had refused to surrender his messages and met his death heroically.

"When he was about twenty-four years old, a party of Comanches (they and Apaches frequently raided together) from the same camp in which he lived, while on a raid into Mexico, attacked a large ranch. The inhabitants, being poorly armed, made little resistance, except a few men, who, getting into a courtyard, vigorously defended themselves with such weapons as came to their hands. All were soon dispatched, except one man, almost a giant in stature and strength, who, although armed only with an axe, killed one or two of his assailants and kept the others at bay. At last an Indian, getting on the wall, threw a lasso over his head, and, jerked off his feet, he was soon bound hand and foot. After the ruthless violation and murder of all the women, the children were fastened in a room, the ranch pillaged and set on fire in a dozen places. Taking with them as prisoner the one man who had signalized himself in the defense of the ranch, the Indians departed for their own country.

"On the long march the prisoner, though closely watched and guarded by day and securely bound at night, was treated with extreme kindness. They complimented his courage in the highest terms; told him they intended taking him into the tribe, and making a great chief of him. The trail followed, after leaving the head of the Neuces River, crossed the southern end of the high table-land known to the whites as the 'staked plains.' At a water hole on this table-land the party halted on several days. Telling the prisoner that they wanted it for some religious ceremony, they set him to digging a hole in the ground. Working with knife and hands, he, in a day or two, completed a pit about three feet in diameter and over five feet deep. Early next morning a rope was tied tightly about the ankles of the captive and wrapped spirally round his legs and body to the neck, binding his arms tightly to his sides. Rigid and immovable, the man was then planted upright like a post in the hole, the dirt filled in and tightly rammed down around him. When all was completed nothing but his head was visible. They then scalped his head, cut off his lips, eyelids, nose and ears; danced around, mocked, taunted and left him.

"On their arrival at the camp the party described in detail their punishment of the Mexican, and in all the tribe it was regarded as an exquisite piece of pleasantry. The man would live, they said, for at eight days, revived at night by the cold of the high Plains, to be driven mad next day by the hot sun beating on his scalped and defenseless head, while myriads of flies would fill his wounds with maggots. This 'joke' gained great celebrity among the southern Plains tribes, and the warrior who proposed it was regarded as an inventive genius of the first order."

A more cruel and diabolical torture could not have been conceived even in the days of Inquisition.

In October, 1855, Fort Davis was established in Texas. A detail of men sent out to search for timber suitable for saw-logs, was surrounded and cut off. The drummer-boy, aged twelve, was taken alive and conducted to the Comanches' camp. As he spoke Spanish fairly well he was questioned by a Mexican boy captive as to the success of an attack upon the post. He told the number of troops (six companies of infantry) and gave details which proved to the Indians that an attack would result in great loss to themselves. Exasperated by this information, they turned the lad over to their squaws.

"These fiends in human shape stripped and tied him to a tree, and for some hours tormented him in every way their ingenuity could devise without endangering life. Becoming tired of this they procured some fat pine knots, and splitting them into small splinters stuck them into the skin until the unfortunate boy bristled like a porcupine. They then set fire to the splinters and danced and yelled with delight when the poor boy cried and screamed with anguish. When the fire burned out they left him tied to the tree exposed naked to the cold of that elevated region. Next morning he was tied, nearly dead on a horse, and carried with the party, but after going about ten miles was found to be dead."

These Comanches and Apaches were thoroughly skilled in methods of torture. The descendants of these same cruel old warriors are to-day at Carlisle and Hampton. They have "taken the white man's road" and accepted modern conditions, and think of war no more. Each year sees a larger percentage of mixed bloods among the tribes. Of those that are increasing—i. e., the steady increase of full bloods—the Navajoes may be cited. As a race, however, the Indian is not holding his own. He is a fit subject for the educator and the philanthropist, for the true ethnologist is interested in the Indian of long ago and not in the humble government wards of to day.

Various Topics

A WONDERFUL SQUARE.

BY L. S. FRIERSON.

A magic square is made by arranging numbers in arithmetical sequence in the cells of a square, so that the sum of every column, whether vertical, horizontal, or diagonal, will be the same. To do this, appears to the uninitiated an impossible feat. However, the case of a square of 4, (as in Fig. 1) has no less than 878 different solutions. Yet, to place the numbers in their cells at haphazard, the chances that a magic square will be produced is only one out of 5,498,042,606.

1	15	14	4
12	6	7	9
8	10	11	5
13	3	2	16

FIG. 1.

71	64	69	8	1	6	53	46	51
66	68	70	3	5	7	48	50	52
67	72	65	4	9	2	49	54	47
26	19	24	44	37	42	62	55	60
21	23	25	39	41	43	57	59	61
22	27	20	40	45	38	58	63	56
35	28	33	80	73	78	17	10	15
30	32	34	75	77	79	12	14	16
31	36	29	76	81	74	13	18	11

FIG. 2.

The magic square shown in Fig. 2 is a very remarkable combination of figures. First, it is a complete magic square, the sum of any column being 369. In the second place it can be resolved into nine smaller squares of nine cells each, separated by double lines. Each of these small squares is itself a perfect magic square, as may be proved by inspection. Third, if a small square be made of the numbers composing the ends of the four columns intersecting the centre of the large square, and placing in the centre, the central figure of the large square, the remarkable square, Fig. 3, will be produced, itself a magic square. Fourth, if a small square of nine cells be filled with one number out of each of the nine small squares, employing the numbers bearing the same relative position, the resulting square will be magic square. For example: Fig. 4 is made up of the central number of each of the small squares. Any set of homologous numbers will produce a magic square.

71	1	51
21	41	61
31	81	11

FIG. 3.

68	5	50
23	41	59
32	77	14

FIG. 4.

Finally, not only will the vertical, horizontal and diagonal columns add up the same, but many other combinations of nine consecutive numbers will also add up this magic result. For example: beginning with the lower left corner number 31, proceed diagonally upward three numbers to 33. Thence proceed to the right ending with the number 15, or from 31 through 33, proceed vertically upward ending with 69. Again beginning with 31 proceed through 33, thence (through 80) diagonally downwards and to the right to 74, thence to 11. All of these combinations of nine consecutive figures will yield the same sum. No less than 21 such combinations may be made having the number 31 as a beginning and ending with 13, 11, 15, 47, 51, 53, 69, 71, 66.

The very remarkable properties of this peculiar square may be noted by comparing it with an ordinary square of the same size, i. e. 9 The ordinary square will have 20 columns yielding the same result, whereas this wonderful square will yield no less than 120, and possibly more.

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FIRST FOSSILS.

BY ARTHUR M. EDWARDS, M.D.

Away down in the oldest rocks there comes a place where the first sedimentary strata begin, that is to say, where the rocks that were formed as deposits from water began. And this was upon the shore of the oldest sea. At that time algæ, low plants and attached animals most likely lived. And their remains, as fossils, must be looked for there. Animals, it is true, have been found, and perhaps plants likewise.

And what are these so-called fossils? Fossils are the ancient remains of animals and vegetables which are dug up out of the earth, not minerals, such as rocks themselves, although minerals were called fossils also not long ago. A dead dog or tree may be fossils when buried in the earth and subsequently dug up. But fossils in the scientific use of the term, denote the remains of ancient animals and vegetables, not necessarily extinct. For we shall see how animals and vegetables existed with just the same characteristics long ago. In fact we find the shells of Diatoms which lived in the time of the oldest rocks, long, long ago, even in the Lower Silurian, and cannot be distinguished from those which are now living in every pool by the roadside. This shows, also, that "species," as they are called, live on and do live on. We shall consider soon whether "species" exist at all.

The etymology is *fossilis*, anything that may be dug out of the earth. But the traces of the existence of any body, whether animal or vegetable, which has been buried in the earth by natural causes, is a fossil. Even the cast of a fossil shell made by mud or clay, hardened, as we find it, is deemed a fossil. So that the casts of footprints which are common in the red sandstone of the Connecticut valley or less common near Newark, N. J., are also fossils. And trees in the shape of buried logs, which turned up in quantities where they made a park, the Branch Brook Park, in Newark, although seeming more recent and containing some wood, changed to peat,—these were also fossils.

In the early part of the sixteenth century fossils were supposed by some Italians to have been formed in the hills by the action of the stars, but how formed they do not say,—whether it rained down fossils, so that they may have been part of the stars themselves. This is the view which, prior to 1579, the celebrated painter, Leonardo de Vinci, combatted. Then the hypothesis arose of a plastic force, or, according to Andrea Mattioli, a fatty matter capable of fashioning stones into organic forms. But the hypothesis which held its place longer than any other, and is not yet extinct among the uneducated, is that they were relics of the Mosaic deluge. In fact, strata are fossiliferous, that is to say, contain the remains of animals and vegetables, as far back as we can trace them. Under that are supposed to be rocks which are fused by heat. Supposed, we say, for first-formed rocks have not been found anywhere.

Microscopic fossils are the remains of animals and vegetables, to examine which it becomes necessary to use a magnifier, a microscope in short, to see the form. Now one of the microscopic forms is called Polycystina, so called from the Greek *polus*, many, and *kustis*, a bladder. Polycystina are what are called a sub-order of the Radiolaria, which are named from the Latin *radius*, a ray. Radiolaria have the parts arranged in rays around the centre. They are microscopic things it must be remembered. They look like glass balls, or very much like ivory balls which the Chinese make, and which are so common in our museums. The Polycystina are very common in the deep sea-bottom, which is brought up by the sounding line now, and are also common in the fossil state in some clayey rock or hardened clay which is known to geologists as the Miocene Tertiary infusorial earth, found in the island of Barbadoes, Trinidad, and Cuba, and elsewhere in the West Indies. It is also found at Richmond and Petersburg in the state of Virginia, and at Monterey and elsewhere in California. So they are called microscopic fossils because they are best seen when using a magnifier to see them.

But to understand what I am going to say it will be necessary to go somewhat into geology. In the beginning let us imagine an island that is unhabitated by animals or vegetables, that is to say one that is thrust up from the bottom of the sea, pushed up by volcanic action or otherwise. The rock of this island is raised up, and is made of constituents which have been melted and cooled again. And as it is the first rock that appears we would call it primary, but that name has been appropriated for the next rock to appear, as we will show. It is volcanic and fused, and so is the bottom rock that geologists are looking for, but have not as yet found. At any rate it stands for some time, years, perhaps ages; we cannot tell.

At last it breaks down, and this is by the wear of the water dashing and breaking against it, and by the rain falling and by the atmosphere wearing it down. So it forms at first gravel, then sand, and then, as the particles become smaller, mud and dust. Or at least the particles are mud by mixing with the water. Or even in some cases it appears as clay. This is where the action is upon rock that has aluminum compounds in it, and aluminum is extremely common in the rocks thus erupted. The gravel, sand, mud and clay are thus deposited on the lowermost parts of the island, that is to say on the shore where it appears on the margin of the sea.

In time, by the evaporation of the water, the mud and clay becomes consolidated into a hard substance which is called shale, or even the sand also become what is known as sandstone. This is by the dissolving of some of the silica by water and precipitating it again to cement the grains. Where there is lime it becomes limestone. By pressure it becomes heated, and it is different, not chemically, but morphologically. It is then said to be metamorphosed. The name comes from the Greek metamorphosis, meaning a transformation so that the rock formed is changed in outward appearance, not chemically. The particles arrange themselves differently. Thus what is known as gneiss is formed. Granite is also formed.

Animals that live in the ocean, dying, leave their remains there in the mud, sand and gravel of the shore, which turning to stone enclosed them, and thus they became fossils, afterward excavated. Their skeleton being calcium carbonate, called carbonate of lime, or calcium phosphate, called phosphate of lime, is sometimes replaced by silicon dioxide, called quartz. Sometimes the flesh and its compounds are changed into what is known as graphite, which is carbon in another form, only harder and crystalline.

So the rocks go on accumulating through what is known to geologists as primary, secondary, tertiary and quaternary ages. How long these took in depositing it is impossible to ascertain, as those best acquainted with circumstances of the case differ. Remember, however, it was long, very long time that the first or primary rocks took in accumulating. The animals and vegetables that appeared then are changed for other forms now. Some animals and some vegetables, and some organizations which are neither animal nor vegetable, distinctly, existed then and exist now. Their skeletons are exactly the same in the oldest rock as are seen now. Among these oldest rocks are what are known as Archean, named by Dana, and the oldest Archean is the Laurentian, so called by Sir William Logan, the government geologist of Canada. This Laurentian was so called from the St. Lawrence, along which they are exposed.

For a long time the oldest fossils were such as were found in newer rocks than the Laurentian. Then Logan found a thing which he supposed to be a fossil in the Laurentian rocks of Canada. Interest was immediately excited among geologists everywhere. He sent it to Sir William Dawson, who examined it and saw it was a fossil and named it Eozoon Canadense, meaning the earliest animal in Canada. Dr. Carpenter, the celebrated English microscopist, confirmed the discovery. Geologists were truly excited. Most of them examined the rocks and confirmed the findings of Dr. Dawson, but two said they could not assent, and accounted for the peculiar appearance by saying it was formed by crystallization and it was not a fossil at all.

The lowest animals, as they are called, are masses of jelly-like organism, protoplasm, or sarcode. They have not decided animal nor vegetable characteristics, but have characteristics midway between. The protoplasm forms a mass of jelly-like substance without any skin or limiting membranes at all, and is without any structure that can be viewed by any power of the microscope. An example is an Amœba, as it is called. And this amœba moves about by thrusting out portions of its body and drawing them in again. It feeds by covering the thing that it feeds on and thus forms for itself a seeming stomach; this is the whole life of the amœba.

Some of the amœba-like are naked, some secrete a skeleton of silicon dioxide —commonly termed quartz or silex,—and some secrete carbonate of lime. Now the Eozoon canadense was one that had a skeleton of carbonate of lime. The jelly-like protoplasm of the animal itself is removed in the fossil and replaced by a mineral of a light green color. So the white of the fossil represents the carbonate of lime, the skeleton, and the light green, the serpentine as it is called, the protoplasm. It can be seen why the Eozoon is so important, for in it we have the earliest animal known to have existed. Foraminifera are also found and Eozoon seems to be a giant Foraminifer.

Fossil wood, although not so old as the Eozoon, is of great interest. Often the wood structure has been little changed, but is darker than ordinary. Some is changing into coal. Hard coal, as it is called, anthracite, is mostly derived from plants, not wood, or has lost its organic traces, so there is rarely any woody fibre to be revealed. But soft coal and peat show logs of wood preserved.

NEW SUPERHEATING BOILER.

Many valuable and wonderful results can be obtained through the use of superheated steam. Superheated steam is an exceptionally hard thing to produce. The problem is a difficult one. Any vessel containing steam alone and exposed to a hot fire will rapidly burn out. If the steam contained be under pressure the result would naturally be disastrous.

Steam cannot be superheated while it is in contact with water. It will, then, be seen that the inventor, trying to solve the problem of producing superheated steam is between the horns of a dilemma. If he endeavors to protect his boiler with water he cannot superheat his steam; if he endeavors to superheat the steam he burns out his boiler.

The superheaters which are now used are placed far away from the fire, where the gases of combustion can only reach them after these have been greatly cooled by contact with the regular heating surface of the boiler. As they are applied they are comparatively small affairs, equaling only about one-tenth of the heating surface of the boiler. Their action is by no means constant nor reliable. Notwithstanding these disadvantages the use of superheated steam has proven to contain such elements of economy as to make its more extended use extremely desirable. Engineers who are experts in the matter of steam production and use declare that, by superheating, a very considerable portion of the great losses now sustained in the use of steam and the steam engine may be avoided.

The newly invented boiler, the description of which we take from the Electrical Age, it is asserted by the inventor will not only produce superheated steam in abundance, but will also enable the users to take advantage of several new principles for the encouragement of evaporation which are now entirely unknown to those engaged in the present way of steam making. It is asserted that crude tests have already been made with a boiler of the new design, working side by side with one of an older type, and that these tests have shown absolutely satisfactory results.

This invention, the inventor states, turns the entire boiler into a superheater. The fire heats the steam direct instead of the water; the water merely serves as a reservoir for the further supply of steam as the latter is used, and to cool the steam to a certain degree and to counteract the tendency of the fire to burn out the vessel containing the steam.

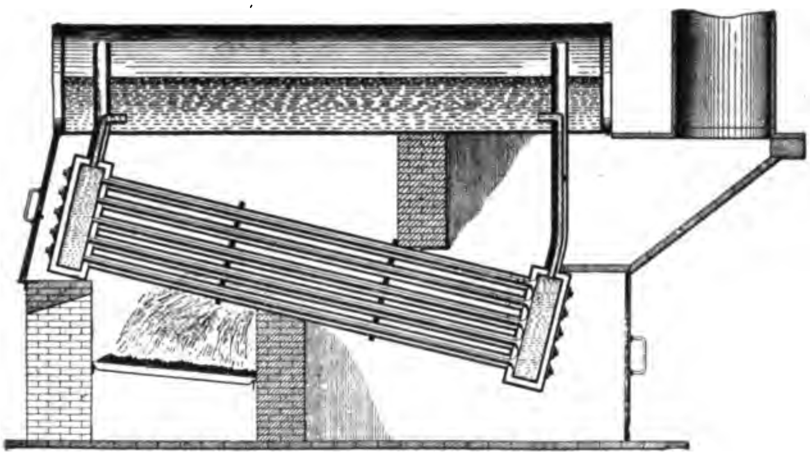
The principle upon which this new boiler is designed is very simple. It is based upon the fact that, if the steam to be superheated be spread in a thin body immediately behind a plate upon which the fire acts, and that if just back of this thin stream of steam there is placed a body of heat conducting material, that this last-mentioned body would carry away such surplus heat as it was not desired to impart to the steam itself, thus imparting to the steam the degree of superheat desired, while at the same time protecting the heating-plate from being burned out.

If we take a tube, say 3 inches in diameter, and place within it another tube 2¾ inches in diameter, there would be left a space one-eighth inch across all around between the two tubes. If, now, we lay this double tube down at an angle, and at the lower end so connect its two parts as to allow water to enter the inner tube and to allow steam to enter the space between the two tubes, then we have the characteristic feature of the new Misko boiler.

In this way the water is steam-jacketed. If we expose this tube and its contents to the action of a hot fire, maintaining the angle at which the tube lies, the fire will heat the steam and the water of the inner tube will cool it. The outer tube, it is asserted, can never burn out because it can never become hot enough. As fast as the heat goes into the steam the water of the inner tube absorbs it. The water of the inner tube becomes heated and ready to provide a new supply of steam to be superheated as rapidly as that steam which has already been superheated is drawn away for use in the engine.

The amount of superheat which would be given to the steam in such an apparatus would depend entirely upon the distance between the inner and the outer tubes. The narrower this space the greater would be the counteracting effect of the water in the inner tube and the less the superheating. It has been calculated that, if this space were reduced to the one-one-thousandth part of an inch, the counteracting effect of the water would be so great that it would be impossible to superheat the steam at all. On the other hand, it has been calculated that, if the steam space were one inch across, then the water would practically lose its effect, and the vessel holding the steam would be burned out.

In the accompanying illustration the invention is shown as it might be applied to an ordinary Babcock & Wilcox boiler. Here it will be seen that the two ends of the inner tubes are connected with the water in the steam drum. The steam space between the two tubes is connected with the steam space of the steam drum. The pressure on the inner tube is the same upon either side of it, and it therefore has no strain to sustain. This tube can be made almost as thin as tissue paper. The cooling effect which would be attained by the use of a very thin tube, would allow for making of the steam space larger than it could otherwise be. This would allow of a superheating of a greater amount of steam in a given time.



THE MISKO SUPERHEATING BOILER.

* * *

Prehistoric Relics in Burma.

To the Zoologist, Mr. R. C. J. Swinhoe contributes some important notes on prehistoric man in Burma. It will be remembered that in 1894 Dr. F. Noetling announced in the Records of the Geological Survey of India the discovery in a bed of ferruginous conglomerate at the oil-fields of Yenangyoung of worked flints in association with the remains of Hipparion antilopinus and Rhinoceros perimensis, thus carring back the existence of man in that country to the older Pliocene or Upper Miocene.

A year later Mr. R. D. Oldham expressed the opinion that, in the first place the flints are not confined to the ferruginous conglomerate, and, secondly, that they are not chipped by man. As the result of a recent visit to the locality, Mr. Swinhoe confirms Dr. Noetling's view that the chipped flints, and likewise certain facetted bones, are the works of men's hands; but, on the other hand, he regards them as of Palæolithic age, the place where they were found being apparently a workshop of that period.

FOREIGN NOTES.

Translated or condensed for Popular Science News.

Poison of Non-Venomous Serpents.—Messrs. Alcock and Rogers have made extensive researches on the toxicity of the saliva of serpents not hitherto considered poisonous, such as various colubers, and find that it is really very toxic. It had been found that one, supposed to be inoffensive—the Xenodon severus, of the United States,—had a poisonous bite. The investigators' report is No. 465, Proc. Royal Soc., London.

Health for Marriage in Spain.—At Madrid the Minister of Justice has recommended that a certificate of health shall be required before license to be married; so reports La Semaine Medicale. It is the first time that a European government official has made a pronouncement on this highly important subject, says the Revue Scientifique.

Meerschaum Mines.—About five thousand Kurds and Persians are employed in mining this precious earth in Turkey. It is found in a red argillaceous earth, at a depth varying from a few feet to over a hundred, and occurs as irregular kidney-shaped masses, of sizes from a nut to an apple. It is cleaned by an army of workers, classified, and sent away enveloped in cotton wadding.

Silicum a Compound.—Th. Gross, in the Elektrochemische Zeitschrift, gives his experiment of subjecting "pure silicium," with caustic potash as solvent, to a long-continued electric current in a silver crucible. The quantity of pure silicium recovered was less than the original weight. The residue, after chemical treatment, yielded a gray metallic substance similar to selenium. The experiment needs confirmation.

Expedient of Snails.—In the Canton de Vaud, a snail cultivator put a horizontal roofing strip, edged with sharp barbs, along the top of the enclosing fence. The snails (Helix pomatia) could not escape over the fence until one or more of them arranged themselves alongside the barbs as steptones for the others to surmount the barbs.

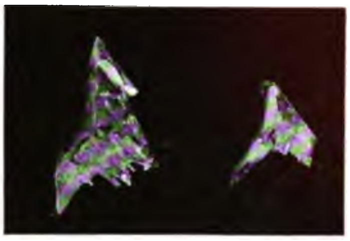
Vaccination Antagonizing Whooping Cough.—Some Italian physicians had noticed the prophylactic effect. Dr. Dietric, in Algeria, as reported in Medicine Moderne, has made extended observations with results enumerated. His conclusion is that vaccination does have a curative effect on the cough, and moreover confers a degree of immunity against that disease.

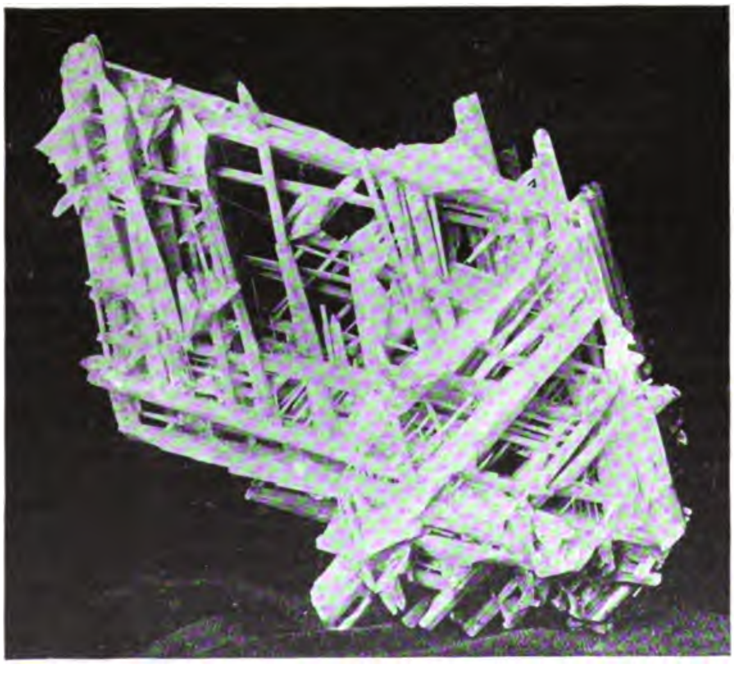
Seasickness Alleviated.—The Gazette Medicale reports the experience of M. Baudouin, who was very subject to seasickness. Adopting a medical suggestion in regard to position in the anæsthetic use of chloroform, he rested in an inclined position at a considerable slope and found relief from the nausea.

Mineralogy

[Edited by A. C. Bates].

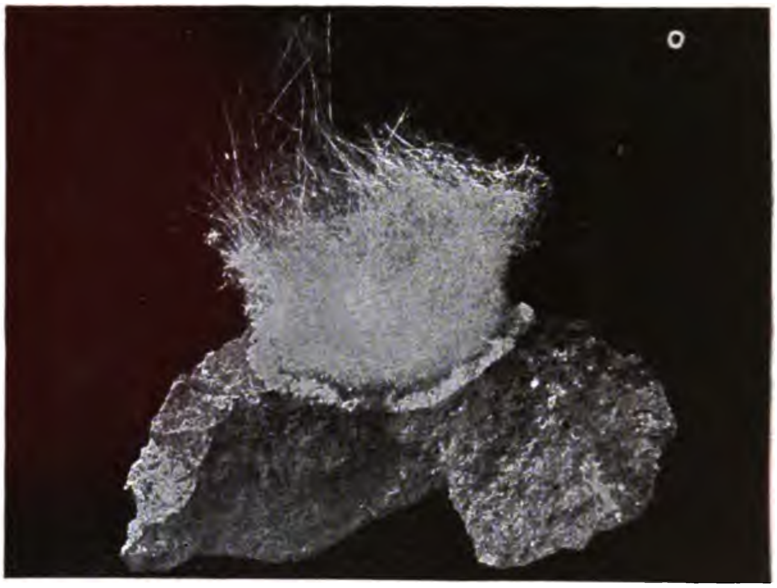
Cerussite occurs in distinct simple crystals, in contact and penetrating twins, and in bunches of thin blades. Fine specimens of transparent crystals loose, or on a matrix, are rare and costly. Some large transparent crystals were found at the Phoenixville and Perkiomen mines, and some of these are prized by their owners as among the chiefest of their minerals from Pennsylvania. Large masses of thin-bladed cystals occur in some of the mines of Leadville, Col., at Flagstaff, Utah, and in Pima Co., Arizona, in masses up to 60 pounds in weight. Magnificent groups of reticulated crystals occur at the Broken Hill Mines, New South Wales, one group of which is shown in the engraving, and which was sold for fifteen dollars. Cerussite is the best known and most beautiful of the many minerals found at the Broken Hill Mines. Some of the groups have anglesite crystals scattered over them, or completely coating them.





RETICULATED CERUSSITE, BROKEN HILL MINES, NEW SOUTH WALES.
Courtesy of Mr. G. L. English.

Cerussite is a carbonate of lead, and is one of the common ores of that metal. In color it is white, gray and black, and is sometimes tinged with blue or green by some salts of copper. It is a very brittle mineral and has a pearly lustre.



Courtesy of Mr. G. L. English. MESOLITE.

Mesolite is composed of hydrous silicate of aluminum, calcium and sodium, and is intermediate between natrolite and scolecite in the zeolite group. It occurs abundantly in the amygdaloids of Table Mountain, Golden, Colorado, in very delicate bunches of long slender hair-like fibers, white in color, and when matted, resembles cotton wool. Sometimes the fibers are so arranged as to appear like fragile gauze or cobweb-like membranes. In other types the fibers are distinct and separate, and form delicate brushes with parallel bristles. For some years the mesolite of Table Mountain was called and labelled thomsonite. Mesolite is one of the few fibrous minerals which it seems necessary to seal in glass covered boxes.

Rock Crystal.—Objects made of rock crystal are always attractive, and if they are highly wrought, the art and labor involved makes them appeal to any one. In one of the large jewelry shops in New York there is now displayed a great variety of objects made of rock crystal, cut, engraved and polished, and so mounted on carved wood or metal bases as to set them off in the best manner. A novelty is in the form of a plain tumbler, not hollowed out, and so beautifully polished is the clear quartz as to appear as if filled with limpid water. Another represents a vase with a small hole bored near the edge in which is the stem of a rose with the flower hanging over the edge. Large crystal balls, plain and faceted are shown in profusion. These objects are as costly as they are beautiful.

Moonstone.—A new form of this mineral has been found near Bakersville, N. C. It is a white or gray oligoclase, transparent or translucent, and remarkable because, parallel to the cleavage plane, there are crystals of red goethite, unusually brilliant by reflected light, so that in one position the stone has the appearance of moonstone, and in another that of sunstone.

Catlinite.—This material is not a definite mineral species, and is classed with the clays. It is an earthy hydrous aluminous silicate and occurs in beds of considerable extent in Pipestone County, Minnesota. It was named after George Catlin, a celebrated writer on the North American Indians. The Indians come from all parts of the country to obtain this material from which to make pipes—hence the common name, "pipestone." The government has set apart the pipestone region as a permanent reservation to secure for the Indians of all tribes, absolute control of this venerated spot, and it is now difficult to obtain specimens of large size.

Amber.—Several large pieces of amber have recently been brought up out of the sea in nets by fishermen off the coast of York, England. One lump weighed over two pounds.

Amber in mineralogy is known as succinite, and is distinguished from other fossil resins chiefly by the 5 to 8 per cent. of succinic acid it contains. Amber occurs abundantly along the coast of the Baltic Sea and sparingly on the east coast of England. In the Royal Museum at Berlin there is a mass of amber weighing 18 pounds. Amber and similar fossil resins are of vegetable origin, altered by fossilization.

Iron.—The Mesabi iron districts lie in that part of Minnesota which is northwest of Lake Superior. Mesabi is the Chippewa Indian name for giant. The development of the Mesabi or Giant Range has been marvellous. In 1890 iron ore was found just north of what is known as the Mountain Iron Mines; in 1892, 4,245 long tons of iron ore were shipped, and in 1901, 9,004,890 tons; the total for 10 years have been 40,404,967 long tons. The Mesabi ores range in texture from large crystalline masses to fine soft dirt, which runs like sand between the fingers. The estimated quantity of ore in sight that contains 58 per cent. of metallic iron is 500,000 000 tons.

Opal.—There is found at Puerto Principe, Cuba, a moss opal which has some resemblance to the moss agate of Wyoming. The moss is of a yellowish-brown color and is well distributed through pieces of opal varying in size from a walnut up to four inches across. The opal is translucent to opaque, in color yellowish to opal white. The mineral has no gem value, but makes a handsome and interesting cabinet specimen.

Anthracite Coal.—That there is a limit to the supply of anthracite in this country is recognized by all authorities. The extent of the anthracite field is but 3,300 square miles. It is located in the state of Pennsylvania, and, broadly speaking, is bounded on the west by the Susquehanna River, on the north by the north branch of the same river, on the east by the Delaware and Lehigh rivers, these three rivers forming the drainage outlet for the region. The valleys containing the deposits generally run from north to south. The greatest length of any of these valleys is 120 miles, while the width is perhaps thirty miles.

According to Lesley, these beds of anthracite coal were originally bituminous in character, and were deposited at the same time as the bituminous coal of western and central Pennsylvania, and were subsequently changed to their anthracite character by some process of metamorphism. The original contents of the anthracite coal deposits have been estimated to be 19,507,872,325 tons. The annual capacity of the mines is estimated to be 67,000,000, while the market will take less than 50.000.000 tons. It is estimated that there is $700,000,000 invested in the anthracite industry, with an annual profit of from $85,000,000 to $100,000,000, added to by freight traffic net earnings of $40,000,000 a year.

The Septic Tank.

More particulars on this subject are as follows: It consists of conducting sewage into large closed tanks capable of holding one day's sewage. The tanks are covered with concrete arches carried by brick piers and levelled over with soil. They are designed to promote growth of liquefying organisms present in the sewage, by whose action the organic solids are broken down into simpler substances which can be dealt with by filtration. The flow through the tanks is uniform and continuous, inlet and outlet being submerged so as to minimize the disturbances of contents of tank by incoming and outgoing streams, and to prevent admission of air or exit of gases into sewers. It is claimed that practically the whole of the organic matter in suspension is by this means rendered entirely liquid.

In the experimental tanks at Exeter, England, it was found during the first few months there was an increase in the depth of deposit in the tank at the rate of 1 inch per month; but after this, when the sludge has accumulated to a certain extent, the bacteria eat it away as fast as it is formed. In addition to layer of sludge at bottom of tank, a scum 3 or 4 inches thick forms at top, and flakes of organic matter fall from surface scum to bottom of tank. At bottom decomposition is going on, bubbles of gas are carried out from fermenting mass at top of tank, and thus many millions of bacteria are continually falling with organic matter from scum to bottom of tank. Bubbles of gas keep ascending to top, and carry with them other colonies of bacteria. The whole mass is constantly interchanging.

Road stuff not dissolved by bacteria. Mineral matter in Exeter sewage 10 parts. At Exeter the intention is to let this matter subside in three grit chambers, each 15 feet square and 15 feet deep. After the sewage has passed through septic tank it is subsequently filtered through biological nitrifying filters, just as the tank effluent from a precipitating tank is filtered. Mr. Perkins, public analyst of Exeter, says the average effluent from the septic tank collected throughout twenty-four hours yielded 0·66 part of albuminoid ammonia in per 100,000, while the raw sewage contained 1.2 parts, the purification effected being nearly 50 per cent.

The system is applicable to anything, from a city to a villa residence, is simple in construction, and the working expenses are small. There are about 200 installations, large and small, in England. The effluent is quite clear and free from smell, and may be discharged into a tidal or other river without the smallest apparent nuisance.

A Lens Revolutionizing Photography?

The "liquid lens" has not come to America as yet, but from all accounts it is revolutionizing photography abroad, making possible achievements in rapid work that hitherto have been thought to be out of the question. In fact, the new development in photographic art is being hailed as no less a wonder than the Röntgen rays.

For, by using a certain oil between the parts of a rectilinear lens, the refraction is so increased that instantaneous photographs may be made in the ordinary light of a theater. This is but one of the photographic feats possible. Another is to take a photograph at midnight on a pitch-black night with no apparent light in fifteen minutes. A third is to make a photograph at midnight, with a fair moon, with one minute's exposure.

Other tested possibilities of this new lens are no less extraordinary. A photograph may be taken in a theater, the footlights only being used, in a quarter second of exposure. In an ordinary room, with an exposure of but five seconds, a photograph may be made, with an illumination of but forty eight candle-power.

Never before in photographic history has there been a lens so extremely rapid as this.

To the ordinary amateur photographer it will all seem to be fiction, but it is none the less an undoubted scientific fact. The liquid lens is an English invention, the device of Dr. Edward F. Grun, of Brighton, England, who has been working on it for several years, and was led to the experiments that have resulted in its perfection through his work with the microscope.

Dr. Grun's early experiments were made with the idea of being able to photograph stage performances at night. He found that the fastest lens he could get was not quick enough to photograph a play in action; that there must be a halt for an instant, posing the figures and losing the time effect, or else the picture would show movement and blur, thus interfering with the natural effect.

A speedier lens became necessary, and finally Dr. Grun devised it, discovering an oil which, placed between the glasses of the combinations of the lens (and not in the air-spaces, as first tried), shortened the focus materially. What this oil is the inventor will not say. Its success, however, has been proved by many extremely fine photographs that the doctor has made. It works at a very large aperture and is thoroughly practical, though in actual operation it can only be used for small plates.

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PUBLISHERS' ANNOUNCEMENT.

On and after January, 1903, the subscription price of POPULAR SCIENCE NEWS will be $1.50, instead of $2.00 or $1.60 when paid in advance. The main reason for making this change is to prevent the confusion that has arisen on many occasions owing to the two prices While the subscription price will be slightly cheaper, it must not be understood that the high standard of excellence will in any way be impaired; on the contrary, both from a mechanical and editorial standpoint, the features planned for Vol. XXXVII will surpass those of previous years.

PHILANTHROPY AND SCHOOLS.

This is the age of philanthropy. The spirit of giving is abroad in the land. Possibly it may be accounted for by the vast increase in our material wealth, and people give because they have more to give. Or it may be that the wealthy realize better than they once did the responsibility of riches, and from a higher moral and intellectual plane look upon themselves as the stewards of the wealth other men have helped them to create.

Be that as it may, the fact is that the gifts and bequests to our colleges and higher institutions of learning, amounts in the aggregate to millions each year. To this must be added the additional millions that are bestowed upon hospitals, churches, libraries and art galleries. All these are worthy objects of philanthrophy, and no right thinking man will for a moment begrudge them the support they receive and to which they are entitled. However, let us stop for a moment to analyze the situation. The hospitals and churches are for the people at large; but the colleges, libraries and art galleries are for those only who have had early advantages. The mass of our people know them, if they know them at all, as great buildings whose interior is to them uncongenial, and whose architectural beauty is often beyond their comprehension.

In this country in particular a general dissemination of knowledge is necessary; it is vital. The very foundations of our commonwealth rests upon the universal education of the young, and yet every year in our cities, the children are turned away from school for lack of accommodations, or are allowed to attend but half a day, in order that their place may be taken by others.

It may be urged that this is a political question, and that it is within the power of the people themselves to remedy this lack of room. True, the same might be said of the hospitals or any other of our institutions; they are all public questions; and still if some are worthy objects upon which the philanthropist may bestow his bounty, why not school buildings for the children ?

What a splendid opportunity is here offered! In some localities the children live in crowded tenements and they must need attend overcrowded schools, and it is no wonder their ideas are often cramped and narrow. What a boon it might be to them if, when they entered their school, there at least they might partake of the sense of comfort, cleanliness, beauty and room.

By far the larger portion of our population enter upon their life work as graduates of the public schools. What better field is there then for him who would so spend his means as best to help his fellow man, than to provide increased facilities for the children of the public school ? For upon their wisdom, some day, must depend the solution of the problems that confront the race. Problems which can and will be solved.

THE HEAVENS FOR DECEMBER.

BY PROF. MALCOLM McNEILL.

The Constellations.—The brilliant groups which form the most prominent features of the starry heavens during the winter months, are beginning to show themselves above the eastern horizon in the evening, although several of them are still low down, and consequently not very conspicuous at nine o'clock, the time for which this description is made out. Taurus is high up toward the zenith, Gemini is in the east, Orion is rather low in the southeast, Canis Minor is low down in the east, and Canis Major with Sirius is just rising in the southeast. Perseus is near the zenith in the northeast and Auriga lies below it. Cetus is low down on the southern meridian. Andromeda is just west of the meridian with Pegasus below reaching nearly to the west horizon. Cassiopeia is west of the meridian between zenith and pole while Cygnus and Lyra are low down near the northwest horizon. Ursa Major is below the pole low down in the northeast.

Phases of the Moon, Eastern time:

First Quarter,	Dec. 8,	1 h. 26 m. A. M.
Full Moon,	" 14,	10 h. 47 m. P. M.
Last Quarter,	" 21,	3 h. 0 m. P. M.
New Moon,	" 29,	4 h. 25 m. P. M.

The winter solstice, the time at which the sun reaches its greatest southern declination and winter begins, occurs Dec. 22, about 1 P. M., eastern time,

Mercury is a morning star until Dec. 12, when it passes superior conjunction with the sun and becomes an evening star, but never during the month is it far enough away from the sun to be seen with the naked eye. Toward the close of the month it is at nearly its farthest southern declination, and sets about three-quarters of an hour after sunset. This is rather too short an interval to allow it to be seen. It will be easily seen as an evening star during January.

Venus became an evening star toward the close of November, and gradually increases its distance from the sun, but remains quite near throughout the month, and at the close it sets only about half an hour later, so it will not be at all easy to see; but it may possibly be made out on a very clear evening during the last few days of the month, very close to the horizon shortly after sunset. It will not reach a great enough distance from the sun to show conspicuously as the evening star for some months.

Mars is gradually moving toward a position where it can be seen in the evening, but has not reached it yet. Toward the close of the month it will rise a little before midnight, but it will not be high enough to be well seen until an hour or two later. It is in the constellation Virgo and moves about 13° eastward and 5° southward during the month. On Dec. 9 it passes about 1° north of the fifth magnitude star *Beta* Virginis. Its distance from the earth diminished from one hundred and forty-six millions of miles to one hundred and nineteen millions; and its brightness increases about 50 per cent. so that it grows from a point below first magnitude to a point considerably above.

Jupiter can still be easily seen in the southwest in the evening, but its time of setting changes from a little after nine to a little before eight o'clock. Its great brightness enables it to show itself until it is quite near the horizon. It is still in the constellation Capricorn, but it has now moved to the eastern side of the constellation. Its motion is quite rapid for Jupiter, about 6° during the month, and is eastward.

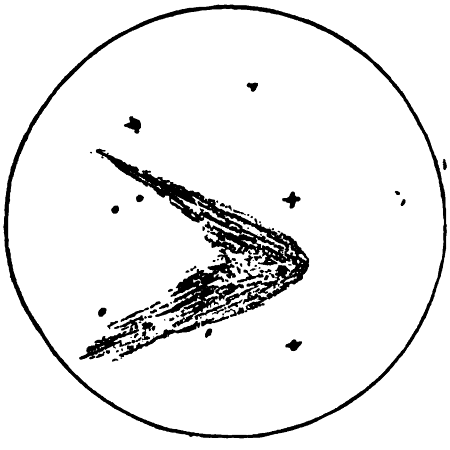
Saturn is also still in the southwestern evening sky, but it is drawing so near the sun that toward the close of the month it will not be at all conspicuous. On Dec. 1 it sets at a little before eight, and at the close of the month at a little after six o'clock, less than an hour and a half after sunset. It can be seen on any clear evening up to the end of the month, but one will have to look carefully on a clear evening to find it. It is in the western part of Capricorn and moves a little less than 4° eastward.

Uranus is in close to the sun throughout the month, and comes to superior conjunction on the morning of Dec. 14, changing from an evening to a morning star. It is entirely too near the sun for naked eye vision, and even with a good telescope it will not be easy to make it out. It makes a very near approach to Venus on Dec. 10, the least distance between the planets being only 8′, about one-quarter of the moon's apparent diameter; but the planets are then too near the sun to be seen even with a good telescope.

Neptune comes to opposition with the sun on Dec. 24. It will then be above the horizon during the entire night, but it will take a good telescope to show it.

Changes in Perrine's Comet.

A Fellow of the R. A. S. reports in the English Mechanic that this interesting body has been showing remarkable fluctuations in the form and extent of its tail. On Sept. 24 the tail was broad and fan-shaped, and developing rapidly as the comet approached the sun and earth. On Oct. 1 a remarkable change in form had occurred, the tail being pointed and looking like a single branch of the former fan. On Oct. 3 this tapering tail had been further reduced, and the comet, though easily visible to the naked eye for some days, was almost reduced to a circular form. The comet does not reach perihelion until Nov. 24, and is not yet at its brightest. The decrease of the tail is altogether contrary to usual cometary proceedings, for generally the tail, once formed, continues to increase up to, and for some time after, perihelion.



SEPT. 24, 11:30.

The Plague on the Pacific Coast.

The board of health of San Francisco has issued a report reaffirming the existence of the plague in San Francisco. The mayor of the city dismissed the board last March, owing to its making a truthful report in regard to the plague, but the action of the mayor was not upheld by the courts.

Hall's Journal of Health

Founded by Dr. W. W. Hall 1854

THE NOSE.

BY O. B. SALISBURY.

Of all the channels through which beauty makes its first appeal to us, there is none more prominent and delicate than the organ of the sense of smell. Its form or type gives the greatest expression to the facial lineaments, and even the voice, taste, and hearing are affected by this organ. Besides these, it is especially concerned in respiration—that is to say, the warming, moistening and filtering of the air, and also the destruction of some of the disease producing bacteria.

The nose is formed of a framework of bones and gristles or cartilages, the latter being slightly acted upon by muscles near the lower bulging sides. It is covered externally by the skin, internally by mucous membrane and supplied with vessels and nerves. The upper end is the root, the rounded or flattened ridge along its middle is termed the back, and this ends below in the point of the nose. The upper or bony part of the back is often spoken of as the bridge, and forms a prominent, normal, or receding angle with the cartilagenous part.

Each nasal cavity is divided by the middle spongy bone into two chambers. In the upper chamber, which extends from the pointed roof of the nose to the under edge of the middle spongy bone, the side wall and the partition are almost parallel, and only about one-twelfth of an inch apart. The olfactory mucous measures thirty-nine one-hundredths of a square inch, of which nineteen one-hundredths is upon the side wall and twenty one-hundredths is upon the partition. The olfactory region extends only upon a part of the upper spongy bone and the part opposite the partition. It approaches about twenty-seven one-hundredth of an inch, nineteen one-hundredth to the border of the upper spongy bone. In other individuals the surface sometimes covers a little less area.

The olfactory cells are essentially formed of a thick nucleus, spheric or oval, surronunded by a thin layer of protoplasm, hardly visible on the sides of the nucleus. It accumulates at the two extremities and gives the cells a spindle-shaped aspect. The outer extremity of the cells becomes thread-like and prolonged with each other as far as the surface, where they are each provided with six to eight fine, short, divergent hairs, which are spread freely upon the surface of the mucous membrane, of a light yellow color. These seem, according to the last analysis, to be veritable receiving elements which come in contact with the odorous particles. The inner extremities of these cells are lengthened equally and rejoin with each other without interruption to the fibers of some twenty olfactory nerves. As through the perforated plate of the ethmoid bone, we can follow these nerve fibers into the olfactory bulb. Indeed, we can say that the channel of activity, from the mucous surface to the central receptory organ, is entirely known to us.

The spaces from which air is drawn through the nose are cones with their points at the nostrils. We may see their size and shape in the clouds of vapor formed by our exhalations in cold weather. The spaces from which odorous particles are drawn are portions of these larger spaces. The breathing-spaces are projections of the whole of the nasal cavities; the fields of smell are projections only of those cavities from which odorous particles reach the olfactory membrane. They are separated from each other by about two-fifths of an inch. In snuffing, through the expansion of the nostrils, the fields of smell become wider than the ordinary breathing-spaces, but as the inspiration is short and quick, they are not so deep.

The current of air drawn into the nose from without is divided by the lower turbinal bone into two portions. From the stream which takes the direct path to the channel under this bone, and along the floor of the nose, no odorous vapor reaches the olfactory membrane.

Under ordinary conditions, the more rapid the breathing, the more intense the smell. Snuffing is to be forbidden in work, not merely because it carries the air higher in the nose, than does regular breathing, but because, both by increasing the suction force and widening the entrance, more air and therefore more odorous particles enters into the nose in a given time.

From close observation and careful notes recorded, extending over a considerable time, I have been led to conclude that the form and shape of the nose, properly considered, gives a decided key to the leading characteristics of the individual. To reduce the study to something like a system, and to assist the observation of form and shape, I divide the most defined organs into three principal divisions, taking the nasal bone as a standard, as it most markedly and materially affects the features.

PRIMARY DIVISION.

No. 1.	No. 2.	No. 3.
Prominent Nasal Bone.	*Normal Nasal Bone.*	*Receding Nasal Bone.*
General Characteristics Denoted.	General Characteristics Denoted.	General Characteristics Denoted.
Firmness.	Generosity.	Obstinacy.
Intelligence.	Shrewdness.	Irritability.
Trustworthiness.	Courage.	Pugnacity.
	Generally temperate.	

Anyone can prove the truth of the science of the nose by comparing the types with those of their friends, whose personal character is well known to them, and noting the form of the nasal organ of public men and prominent personages. There is no better place for a careful study and close observation of the vast variety of form the nose assumes, than a crowded concert hall, church or other place where people congregate; but sufficient may be gathered from these few rough notes to show that the subject is worth the attention of all students of human nature.

Care of the Nose.—The region of the front nostrils, from their exposed position, is frequently the source of illness, owing to infection, the infective material being carried by the air, water or dust. To keep the mucous membrane in a healthful condition, the first requisite is cleanliness. After washing the hands and face, the nose should be blown and washed in the area of the hairs at the vestibule with soap and water. The number of bacteria can be further diminished by thoroughly sniffing up the nose from the palm of the hand some bland, non-irritating preparation like Dobell's solution, 3 ounces, and listerine, 1 ounce.

Aside from the bacteria, a cold in the head is indirectly attributable to a want of harmony between the state of the temperature and the warmth of the dress. Pimples render the blowing and wiping of the nose very painful. They should be smeared with cold cream. Slight bleeding will cease spontaneously, or by the use of such familiar home remedies as cold applications over the nose, at the back of the neck, by placing the feet in hot water, or by plugging the front nose with absorbent cotton.

Germs in Telephones.

Dr. M. K. Allen, City Health Officer of Louisville, has a strong belief that germs of various diseases can be transmitted from one person to another through the transmitter and receiver of a telephone. He has had this belief for several years and knows of one instance where he is confident consumption was communicated to a young woman by the frequent use of a telephone and by pressing her lips against the transmitter while talking. This case set the doctor to thinking, and he is now preparing to make a test of his theory in his office at the City Hall.

Dr. Allen says a thorough cleaning of telephone transmitters and receivers with chemicals at regular intervals is, he thinks, one of the best methods to prevent the spread of disease germs from this source.

New Cure for Scarlet Fever.

The conference of German doctors, in session at Carlsbad, announced the discovery of a new cure for scarlet fever, which has repeatedly proved to be successful. Dr. Moser, the assistant physician at St. Ann's hospital for children, at Vienna, is the discoverer of the new serum. During the last two years he has tried it on 400 patients. The mortality has decreased to between 8 and 9 per cent. The rate at the other hospitals is double.

Correspondence

Wayside Flowers of Washington.

Editor POPULAR SCIENCE NEWS:

The most common flowers of midsummer in Spokane Co., Washington, is without doubt Achillea. I presume the species is Millefolium, and that it is known everywhere by its common name of yarrow. It grows everywhere along the roadside, in corners of fields, along fences, in every waste place in the woods or on the prairie. And its white flowers form a contrast with many more modest wayside flowers.

Clarkia pulchella, with its pretty pink flowers, is the most showy plant we have. The flowers are easily distinguished by the four three-lobed petals, and four-lobed stigma, which looks like a tiny flower itself.

Geranium incisum grows where the soil is good, and is usually seen in company with our many lovely wild roses. The wild geranium bears such a strong resemblance to its relative, the common window plant, that I fancy everybody knows it is a geranium; it is seldom called cranesbill. A few people call it alum root, a name I do not find applied to wild geranium in any of my books. In Gray's Field, Forest and Garden Botany, alumroot is given as a common name for Heuchera, as it also is in Coulter's Manual of Rocky Mountain Botany. In the same places where geranium grows we often see the tall willow-weed, Epilobium spicatum. The last three flowers are very similar in color.

We have several species of Erigeron, some blooming quite early, others that bloom with the asters in late summer. I recently counted five species, but can only name two: Erigeron chrysopsides, a low-growing perennial plant, having narrow, pale green leaves, and pretty daisy-like flowers of a clear bright yellow. It seems to be generally known as golden daisy in my neighborhood. E. corymbosus is more common, as it grows on the prairies and in the woods.

A low, trailing plant that confines itself to barren soil and rocky places, where it forms broad mats of pretty yellow clover-like flowers, is Hasaekia decumbens.

Another plant that likes the same kind of soil is Eriogonum niveum. The Eriogonums are very common here; we have at least three species, and a few varieties as regards color. We have no common names, but the color of the flowers suggested to the children the fanciful names of strawberries-and-cream, peaches-and-cream, and lemon drops. The Eriogonums are often host-plants for the queer little parasite, Aphyllon. A. uniflorum and A. fasciculatum are both common, and I have found a pure white form of the first-named species, which is rare.

We have only one species of Calochortus, which is really our most attractive flower at this season. It is not very common, therefore the finding of it gives us much pleasure. Calochortus macrocarpus has cup-shaped flowers, hence its common name, wild tulip. It is easily recognized by its pale lilac-colored flowers, having three segments of the perianth broad, and three alternate segments narrow and pointed. The base of each segment is marked with purple, yellow and black hairs, arranged in triangular figures.

A perennial Gailardia gives us the brightest yellow flowers at this season. The flowers are often marked by red, a purple-red or brownish-red: at the base the disk flowers are the same dark color, but sometimes we find a plant having pale straw-colored flowers. Arnica alpina is another composite flower that is abundant. The color is lighter yellow than Gailardia, and the plant is never as showy.

Lupines of several species give us lovely flowers of blue, purple, pink and white, from early spring until frost comes. The species blooming in July are L. sericeus, L. leucophyllus and L. polyphyllus. The first-named has the widest range and blooms longest. The pink and white forms of L. sericeus are rare and consequently very attractive.

I have mentioned only the most common flowers, leaving rarer ones and those that may be seen in August and later, for another time. SUSAN TUCKER.

A Visit to the Zoo.

Editor POPULAR SCIENCE NEWS:

Whatever sightseeings a city may have, it does not seem complete without its zoo; and to me the most fascinating place in Washington, the nation's capital, is the wild acres in the suberbs where the animals are kept.

After entering the grounds, one usually makes his way straight by the buffaloes and queer humped cattle to the big elephant barn, where Dunk and Gold Dust stand swaying before a line of wide-eyed youngsters, as near the rope as papa's hand will allow them.

Somehow, the people who come to feed the animals, never have the presence of mind to bring anything but the inevitable peanut; so most of the animals, and the monkey in particular, assume facial expressions of disgust at the steadily extended dainty. But the elephant never seems to lose his good nature or his appetite, and every one is at once reached for, and folded away with an elephantile expression in the twinkling eye that says, "How nice, thanks!"

When the bag of peanuts is gone and one feels his presence in the building is therefore superfluous, two ways of exit present themselves—to the main building or past the kennels of the wolves and bears, among the animals that need solitary confinement. Although I usually strolled all around the grounds, there were a few choice places I always visited; the monkey cage, the coon tree and the otter pond. Perhaps this reason lent its charm to the last three places. The occupants always seemed contented and at home, whereas the pacing lions and tigers looked so unhappy, the writhing coils of mottled boa constrictors, so loathsome and creepy, and the other creatures so clearly "caged" that half the pleasure of watching them was gone.

One day I followed nearly at a standstill, two turtles wending their way along the path, enormous fellows at least a foot in length. At their rate of locomotion they would not be likely to run away without arrest. Another morning, I stood a long time beside the lions, father, mother and two four-day old cubs. The latter were such tiny mites, out of all proportion to their mother and still more to His Highness, their father. They were as much of a contrast as a Newfoundland dog with a kitten-sized pup.

Across the way in the monkey cage, there was enough amusement to last a lengthy lifetime. The crafty cynicism of one old ape, the mischief embodied in one agile middle-aged female and the never-tiring chasing propensities of the little monks I never tired watching. The coon tree was a striking appearing object at noon, a dead tree, so its leafless, barkless bareness was alone conspicuous, but when all its crotches were inhabited by fluffy little napping coons, apparently headless, and sometimes tailless, the effect was something to remark upon.

A little beyond the coon tree, the otter swam about in his artificial pond. His sleek seal face was very gentle in expression, and he came flopping up the bank as close to me as the intervening wire would allow, and begged for food in a way that quite won my heart. I had only a slice of bread and butter that I had in my hand when he lured me away from the lunch basket. I handed him a bit; he snatched it, and made off so quickly, I feared he was frightened. But that only proved my ignorance of otter etiquette. Splash into the water he went, turned over flat on his back and swallowed the bread, then came puffing back to plead for more. He ate in this way all the bread I had to give him, and it has been my puzzled question ever since—"To swallow right side up; was it a physical impossibility?"

MYRA A. LAMPREY.

Calculating Device.

Editor POPULAR SCIENCE NEWS:

Many years ago, a Chinaman taught me the use of the calculating machine about which "Math." asks in your November issue and, if I remember aright, this is the method. Diagram 1 represents the base of the machine ready for use. It will be seen that both the arrangement and the numbering are different from the surmise of "Math."

In use the balls in the lowest line are slid to the left, one by one, as in diagram 2. When number 5 is reached they are swept back, and ball number 5 in the right compartment is slid to the left as in diagram 3. These are again counted off to the left, and when ball number 5 is reached the second time they are slid back into

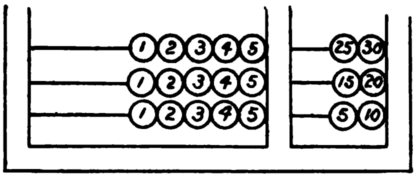


DIAGRAM 1

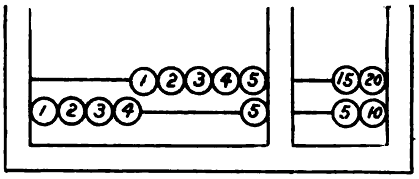


DIAGRAM 2.

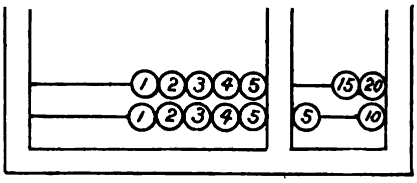


DIAGRAM 3.

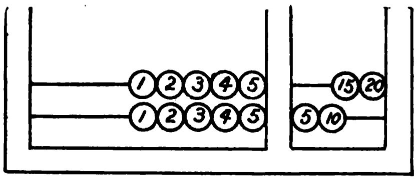


DIAGRAM 4.

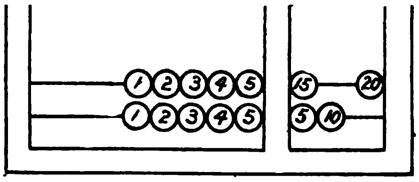


DIAGRAM 5.

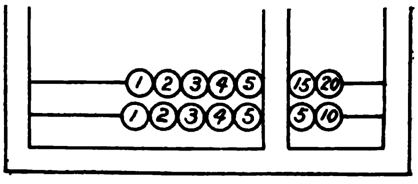


DIAGRAM 6.

place and ball number 10 is slid to the left as in diagram 4. Numbers 11 to 20 are similarly counted on the second row up, and at the reaching of 15 and 20, the balls of those numbers are slid to the left as in diagrams 5 and 6. ALBERT H. HALL.

Liquid Fuel.

For storage, liquid fuel has a slight advantage over coal. It has been approximated that one ton of liquid fuel will require thirty-six cubic feet of storage, and steam coal from forty-three to forty-five cubic feet.

Questions & Answers

QUESTIONS NOT ANSWERED.

Answers are solicited, especially for all questions so far without replies. Questions will appear but twice, successively. The following questions need reply—401, 415, 416, 417.

416. The Sun's Displacement. Is the entire sun visible by refraction, ever, after it has really set? And why does it often seem flattened? SOL.

417. Bloom on Fruit and Sea. What is the cause and nature of the bloom on ripe grapes and plums, etc., and also on the surface of the sea at a distance?

JOHN K. LEADER.

418. Wigwagging of Leaves. I notice frequently that a leaf will wigwag, perhaps very actively, while the other leaves are quiet; then it will cease, and some other leaf will begin the same performance. How can this be accounted for? It seems almost supernatural. J. K. L.

419. Rain Drops on Leaves. Why do rain drops or dew drops on certain leaves assume a spherical shape, and with a pearly lustre? It is not so on all plants.

J. K. L.

420. Lightning. Is lightning always instantaneous, from cloud to earth? Some authorities say so, but I do not believe it.

WILHELM ERNST.

421. Razor Strop Paste. How is razor strop paste made? F. P.

422. Enlarging a Negative. I would like to know what is the simplest method of doing this, by the amateur, and if he can do it with his usual camera. W.

423. Grafting Plum Trees. How can this best be done, or effectually?

SUBURB.

424. Cramps. I am troubled with cramps in the feet and legs, especially after retiring at night. Can any one give the cause and cure? G. T. T.

425. Duplicator. What is the best recipe for a duplicator and for duplicating ink? A TEACHER.

426. Lightest Wood. Can some one of your readers tell us what kind of wood is the lightest? FORESTER.

427. Fireproof Wood. What is the best method of rendering wood incombustible? Will coating of silicate of soda do it? I have some floor joist laid against a chimney which sometimes get quite hot. I want to make them fireproof. H.

428. How Pronounce Nature. Is it correct to say na-chur or should it be nat-your, or na tyure? Authorities differ, and even the same dictionary gives two different pronunciations as eligible, while the two great recent American dictionaries queerly give us in the "key to pronunciation" the very word itself as explaining its own sound! T. O. DAY.

429. Kerosene Odor. What is the readiest and most effectual way of freeing one's hands from the smell of kerosene? R. M.

430. Leaf-Hoppers on Grape Vines. How can they be exterminated or at least decimated? There were clouds of them on my vines; they were very small, and white, except that, on close inspection, they had faint yellowish cross bands on the wings,—the color differing from Harris' Tettigonia vitis on his Plate III. It is said that they injure the vines very much if continuing year after year. LONG ISLAND.

431. Bird Lime, Etc. How is bird lime made, and what other sticky substances can be used to catch insects? LONG ISLAND.

432. Water-Stone. I have a transparent white stone, from South America, which contains a drop of water in its interior, moving when the stone is moved. How did it get there? A. PHILLIPS.

433. Best Clay for Bricks. What is the best composition of brick-clay? Is it pure silicate of alumina? G. G.

434. Transparent Colors. What named colors are used for transparent pictures or letters on glass or curtains? C. N.

435. Tanning Leather. What is the quick process that has superseded the old bark vat? This may explain the poor quality of modern leather binding. JOAKIM.

436. Loss of Metals. What becomes of the vast amount of metals, both common and precious, that have been used for various purposes? Where is the accumulation that ought to have been going on for ages? F. T. T.

437. Hudson River Covers Volcano. A New York evening paper had this title, and claimed high authority for it. Was there ever such a thing there? EMMET.

438. Japanese Fowls. I would like particulars about the long-tailed Japanese fowls. FANCIER.

ANSWERS.

297. The Great Wall in Mississippi. Some time ago a question was asked in POPULAR SCIENCE NEWS as to what is known of the great wall in Mississippi. As I read something concerning it the other day in a New Orleans paper, I thought it might be of interest to you to send you a clipping, as follows: "The Brandywine neighborhood in Claiborne county is to the front now with the report of a gold find. It is stated the stratum in which the nuggets were found extends for a distance of about three miles. There is reported to be a good deal of excitement in the neighborhood, and a man named Hall is said to be trying to buy up the mineral rights of all the property in that vicinity. Popular belief in the credibility of the gold find in the Brandywine neighborhood would doubtless be stronger if it were not recalled that the same neighborhood produced about a couple of years ago the great prehistoric wall, built by the aborigines, antedating even the Indians, which created something of a ripple in Mississippi and elsewhere. Investigation, however, demonstrated that the so-called immense artificial wall was a sandstone formation, and not the work of human hands at all. C. FORKERT.

391. Stammering. One of many methods recommended, is for the stammerer to read aloud in concert with others. P. S.

407. Boiling Potatoes. Confirming what Phil. Osopher says, a scientific writer commends the use of a steamer in cooking, and remarks that the starch of a potato may be converted into dextrine by too long a boiling or even steaming after sufficiently softened, so that the potatoes lose a firm and floury quality. COOK.

407. Boiling Potatoes. So far as boiling potatoes is concerned, nothing is gained by violent boiling. When water begins to boil, it then remains the same temperature until it is converted into steam. The rate of boiling will not influence the temperature of the water. The water in an open vessel may be raised above 212° F. by increasing the density of the water. This is done by dissolving some substances, e. g. salt, in it. H. P. FINKS.

409. Tarnished Silver. Plated ware or even solid silver ware will tarnish in an atmosphere which contains sulphuretted hydrogen (H_2S). Tarnishing of silver ware is usually due to the action of this gas upon the silver, forming a sulphide of silver. If there are sulphur springs near this would readily be accounted for. H. P. FINKS.

413. Dangers of Football. The present scheme of the play is well known to be extremely dangerous. Five deaths, for instance, were recorded this season between Sept. 29 and Oct. 25, besides the following injuries, doubtless but few out of many more: Oct. 9, W. Snyder, Cornell, knee injured seriously; Oct. 12, W. Bassett, New York, collar bone broken; Oct. 18, Capt. Cummings, abdomen injured; Oct. 21, Capt. Weeks, University of Michigan, leg hurt, blood poisoning set in; Oct. 21, Wikoff, Syracuse University, arm broken; Oct. 21, Morris, Syracuse University, arm injured; Oct. 21, A. Bowman, Yale, slight concussion of brain; Oct. 24, Geo. C. Bird, Jr., Plainfield, N. J., brain concussion, skull fracture; Oct. 25, Capt. Harold Weekes, Columbia, ankle sprained; Oct. 25, Burke, Princeton, collar bone broken; Oct. 25, Kafer, Princeton, collar bone broken; Oct. 25, Howard Heary, Princeton, spinal column injured, slight paralysis. Minor injuries have been so numerous that comparative few have have been announced. The game, as played, is certainly one that is "against public policy" and should be regulated by law. It is strenuous enough without great risks. S.

413. Dangers of Football. There were no such mortal perils nor even maiming in the old-fashioned game; the kicking of shins was the only incident. And there was no knockball game with balls hard as stone and fired as if from a gun. Yet we had as much fun and exercise out of these games in the old style. And they cost nothing, whereas now they are expensive to colleges and clubs. I received lately a printed appeal from my Massachusetts alma-mater to help raise $1,300 for the games this year. Not a cent. OLD GRADUATE.

414. Asthmatic Breathing. This is a nervous spasm of the bronchial tubes that carry air into the lungs, and as a consequence impedes respiration and therefore hinders the circulation and oxygenation of the blood in the lungs. It gives a sense of suffocation. It is not dangerous to life unless complicated with heart disease or chronic bronchitis. The most favorable surroundings differ in different cases; so also the medicines used. Careful diet and light exercise, promoting general health, are important. To forestall an impending attack, strong coffee, or effervescent hydrobromate or citrate, may be of use. Chloric ether or ammonia, or the smoke of nitre paper burned, often give relief when inhaled. The various drugs that are employed as doses should be prescribed and used under a physician's directions. N. B.

418. Wigwagging of Leaves. This is amusing and many must have noticed it. If we could see all the little currents of air, varied in every way and affecting leaves that are at various angles, it would not seem so mysterious. OBSERVER.

419. Raindrops on Leaves. The drops, as round and pearly, are generally due to hairs on the leaves, which prevent the water from coming into flat contact with surface; hence the water coheres in globular form as it does when falling on an oily surface where it cannot spread and be absorbed, or as it does on the top of a hot stove where a drop rests on a cushion of its own steam instantly formed beneath it. In the common Tropæolum of garden grounds (mistakenly called Nasturtium), the orbicular leaves give fine examples of pearly rain or dewdrops. The leaves seem hairless, but when examined with a magnifier are seen to be covered with short hairs.

As to the pearly effect, it is of course the reflection of light from the inner opposite surface of the drop. JANET.

419. Raindrops on Leaves. Some plants have leaves covered with an oily wax-like coating to protect against biting insects. This coating prevents the water from coming closely in contact with the surface of the leaf, i. e. prevents the force of adhesion from acting. This allows the sister force, cohesion, to exert her force without opposition, so the particles of water are pulled together in a spherical shape. H. P. FINKS.

421. Razor Strop Paste. Here is one of the recipes: Mix oxide of tin (termed "putty powder") with a sufficient quantity of saturated oxalic acid solution to form a paste. When a little of this is used on a strop, a wonderful keen edge results. (2) Crocus powder and grease is a common mixture for this purpose. J. F. HAWS.

422. **Enlarging a Negative.** The text-books give methods. W. L. G. Bennett says, in the English Mechanic, that if the inquirer possesses a half-plate camera with long extension, he can place the negative against a window where there are no trees or houses behind, put the camera close to it, and focus sharply, moving the camera until the image is the right size. Insert a sheet of bromide paper in dark slide and expose. SCISSORS.

423. **Grafting Plum Trees.** From the same source, I gather this advice: Cut the limbs of the tree off level where you intend to graft. Now cut a slit in the bark, and pull the bark away from the wood a little. Thin the end of the young graft, place it on the tree making a good fit. Place the bark over, bind up tight with bass, and cover with grafting wax or clay. You can graft one, two, or three pieces on the one limb. SCISSORS.

424. **Cramps.** The general state of health, and especially of the nervous system, and sometimes special ailments, have much to do with cramps of foot or leg, no doubt. One writer thinks that shoes are often responsible. He says that these ailments may be caused by constriction of the natural operations of pedal action, and that the relief or ease might be had with broad soles, and large slippers worn for household use instead of boots. In fact, the best shoe in these cases would be the old sandal still in use in Eastern countries, allowing the toes to expand as nature permits, with oil as a lubricator.

J. D.

424. **Cramps.** Sufferers from cramps will find instant relief by this simple method: When attacked by the malady, turn up the toes (ankle motion) as far as possible. This draws up the muscles of both the calf and thigh and relief comes at once. Many bathers at seashore resorts have followed my instructions as here given, with satisfactory results.

E. S. L.

Reanimating the Dead.

In a dispatch from Moscow the correspondent of the London Daily Mail says that Dr. Koulatke has succeeded in his experiments in reanimating the heart of an infant which he had extracted from a child who had died twenty-four hours previously. The heart beat with normal regularity for one hour. Dr. Koulatke hopes that his discovery will assist in reanimation in cases of death by drowning.

Malaria Medicine.

A decoction of coffee husks has been used as a remedy for malaria by Dr. Restrepo, of Medellin, in the state of Antioquia, Colombia. It was found effective in cases where quinine failed, and in other diseases as well.

BOOK NOTICES.

The Book of Climbing Plants. By S. Arnott. Under the general editorship of Harry Roberts. Cloth, $1.00.

The series of horticultural guides published by John Lane, entitled "Handbooks of Practical Gardening," has just included among its volumes one called "The Book of Climbing Plants," by S. Arnott, illustrated in half-tone. Enumeration of the chapter-headings will best convey an idea of the scope of this compact little work. The subjects treated are as follows: Soil, Planting, After-Management and Propagation; Annual Climbing Plants; Hardy Deciduous and Herbaceous Climbers; Hardy Evergreen Climbers; Hardy Wall Shrubs; Climbers Under Glass; The Rose as a Climber; The Clematis as a Climber; Selections of Climbing Plants and Wall Shrubs.

It seems unnecessary to speak at length of the value of the climbing plants in our gardens and pleasure-grounds. They are equally ornamental on the walls and terraces of the stately mansion, and on the humblest cottage, over whose low roof a mantle of rose or clematis sheds such a transforming cloud of beauty.

How to Attract the Birds. By Neltje Blanchan. Pp. 220. (Indexed.) Cloth, $1.35, net. Doubleday, Page & Co., New York. The author of "Bird Neighbors" has in this book presented a number of ideas that will be of great interest to bird-lovers, especially the chapter on "How to Invite Bird Neighbors." The chapters following will give an idea of the text: The Ruby-Throat's Caterers; Bird Architecture; Home Life; Nature's First Law; Songs Without Words; Why Birds Come and Go; What Birds Do for Us; Some Naturalized Foreigners. The charm of the book does not depend entirely upon the text, for it is printed on plate paper and contains nearly one hundred half-tone engravings, many of them full page.

The Book of Bugs. By Harvey Sutherland. 12mo., pp.223. Cloth. Street & Smith, New York. For several years, Harvey Sutherland's accounts of bugs and "kindred creatures," published in Ainslee's Magazine, have attracted wide-spread attention. There was an urgent demand that the author write a book on "Bugs," and the volume is now before us. It gives interesting accounts of all kinds of bugs, both domestic and foreign, but the larger portion of the work deals with those creatures familiar to all.

There are chapters on flies, mosquitoes, fleas, the busy bee, the ingenious spider, foes of clothes and carpets, the aristocrats of the kitchen, and many others, all told in a style full of rare wit and humor, and still teeming with valuable information. At certain points the story of the tiny creatures which surround us becomes as fascinating as the most absorbing novel. Mr. Sutherland, who is fully as much of a scientist as a humorist, tells how these creatures build their homes, prey upon their neighbors, have mimic battles, go courting in their most shining colors, make slaves of other insects, and do a hundred and one other things of which the average person knows but little. The volume contains a number of illustrated chapter headings by Mr. Frank Verbeck, and 42 scientific illustrations of bugs.

The Public and The Doctor. By a Regular Physician. Pp. 149. Cloth. Published by Dr. B. E. Hadia, Dallas, Texas. The intention of the author is to bring into close relations the physician and the patients. He strongly decries the various schools, and in a very straight-forward way upholds the man of scientific training. This little book contains a great deal of common sense, and is timely inasmuch as there are so many "healers" advertising themselves throughout the country.

Through the First Antarctic Night. By Frederick A. Cook, M.D. Pp. 478. Doubleday, Page & Co., New York. $2.00. In this narrative of the Belgian Antarctic Expedition, of which Dr. Cook was the surgeon, he has selected such notes and data as might prove of interest to the general reader. Discussions of technical topics and the scientific observations, descriptions of specimens, and scientific deductions will be published in other channels. The illustrations, of which there are one hundred and thirty-one, including three colored plates, are mostly from photographs by the author. While we have had much literature from the pens of various explorers seeking the north pole, and of those in search of the seekers, the south pole has not yet claimed the attention of scientists to any extent; and as the perilous voyage of the "Belgica" is very entertainingly told, the book will be appreciated by the general reader.

American Animals. By Witmer Stone and William Everett Cram. Doubleday, Page & Co., New York. Pp. 318. Price, $3.00. The aim of the authors has been to produce a work sufficiently free from technicalities to appeal to the general reader, and at the same time to include such scientific information relative to our North American mammals, as would be desired by one beginning their study. In the volume is included a key for use in identifying unfamiliar mammals, and including characters omitted from the body of the book. The work contains over one hundred colored plates and half-tones, mostly from the brush or camera of A. Radclyffe Dugmore. The pages having wide margins and rough edges, the book is not only valuable from a scientific standpoint, but artistic as well.

Report of the Smithsonian Institution for 1901, contains fifty articles, many illustrated, nearly all prepared by specialists, telling clearly the latest progress in the principal branches of knowledge. The Smithsonian reports may be purchased at cost from the Superintendent of Documents, Washington, D. C.

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